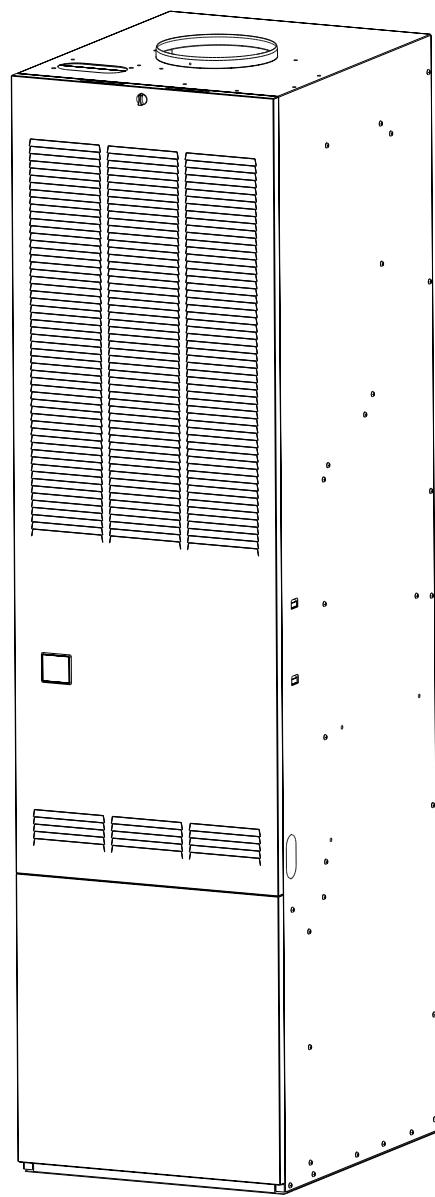
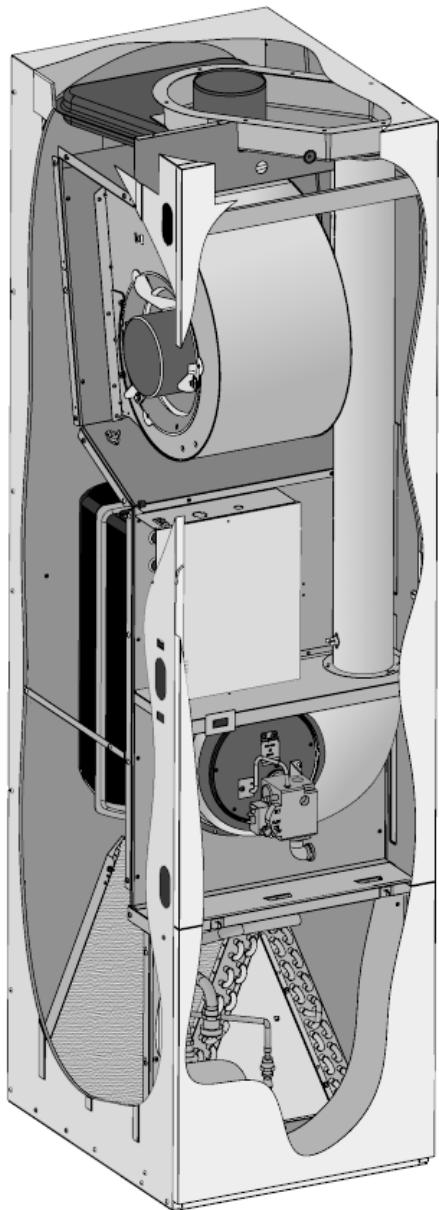
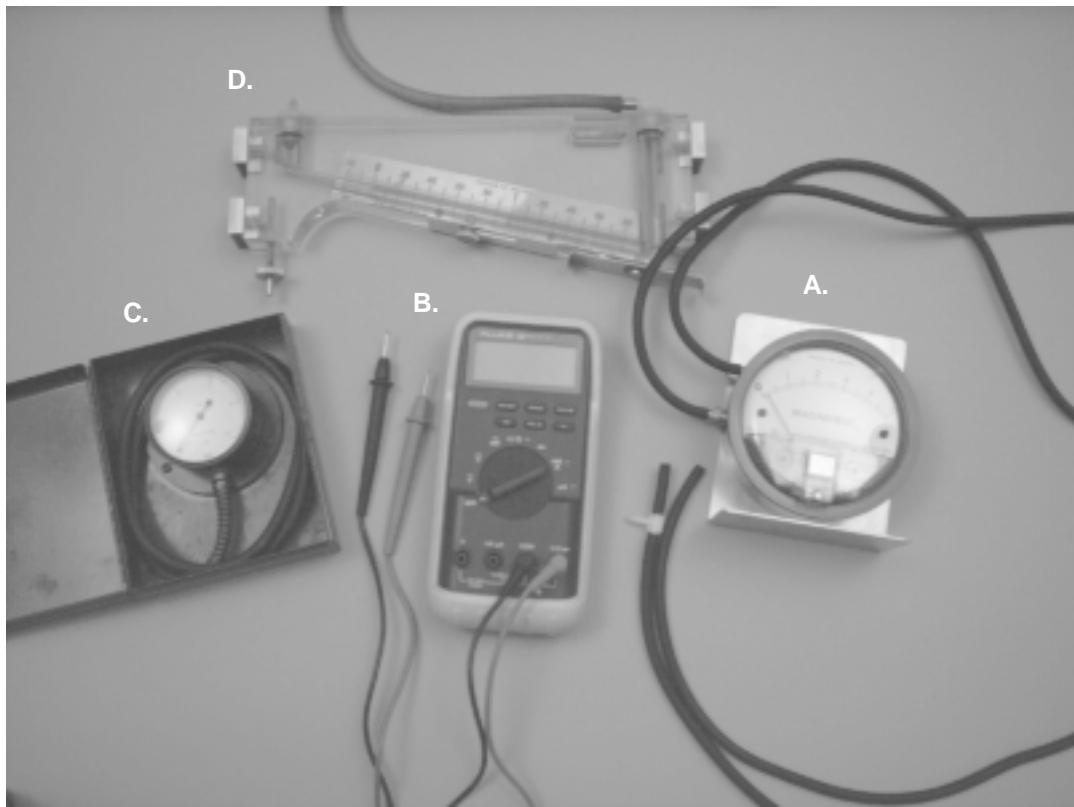


M1 Series

M1G and M1M Furnaces



Service Manual



Typical meters used to service M1 furnaces.

- A. Differential Pressure Gauge**
- B. Volt-Ohm Meter**
- C. Manometer**
- D. Inclined Manometer**

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INTRODUCTION

This service manual is designed to be used in conjunction with the installation manual provided with each furnace.

The downflow sealed combustion furnaces illustrated in this service manual represent the very latest in high efficiency gas furnace technology. Certain controls within the furnace consist of highly sophisticated electronic components which are not user serviceable. It is essential that only competent, qualified, service personnel attempt to install, service, or maintain this product.

This Service manual was written to assist the professional HVAC service technician to quickly and accurately diagnose and repair most malfunctions of this product.

This service manual covers standing pilot and hot surface ignition gas burner models. The overall operation of both of these models is essentially the same, with the exception of certain controls which may be unique to each model.

This manual will deal with all subjects in a general nature (i.e. all text will pertain to all models) unless that subject is unique to a particular model or family, in which case it will be so indicated.

It will be necessary for you to accurately identify the unit you are servicing, so you may be certain of approved diagnosis and repair. (See Unit Identification, Below)

This manual was prepared by the senior Technical Service Department and the Communications Department.



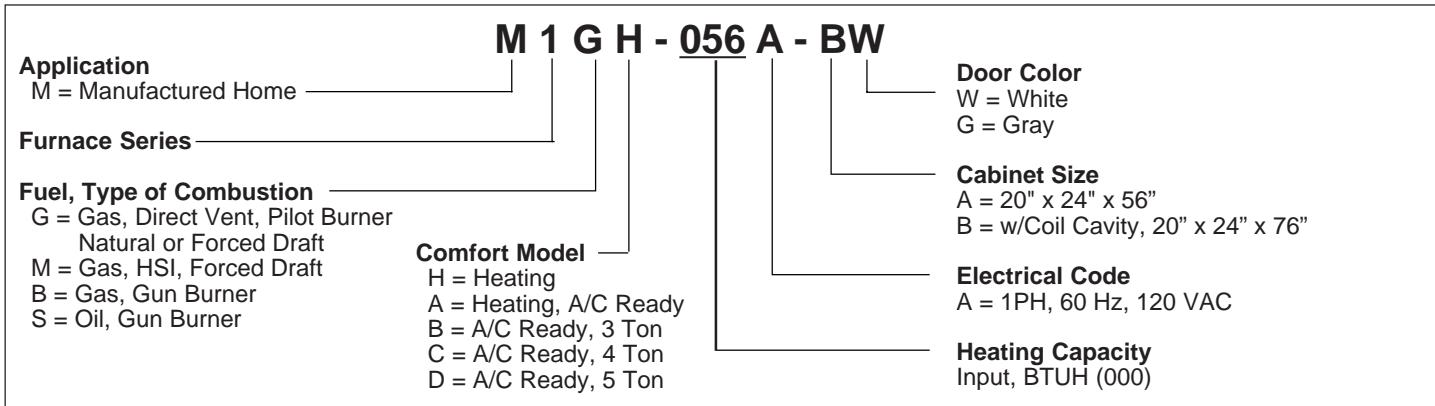
WARNING:

The information contained in this manual is intended for use by a qualified service technician who is familiar with the safety procedures required in installation and repair and who is equipped with the proper tools and testing instruments.

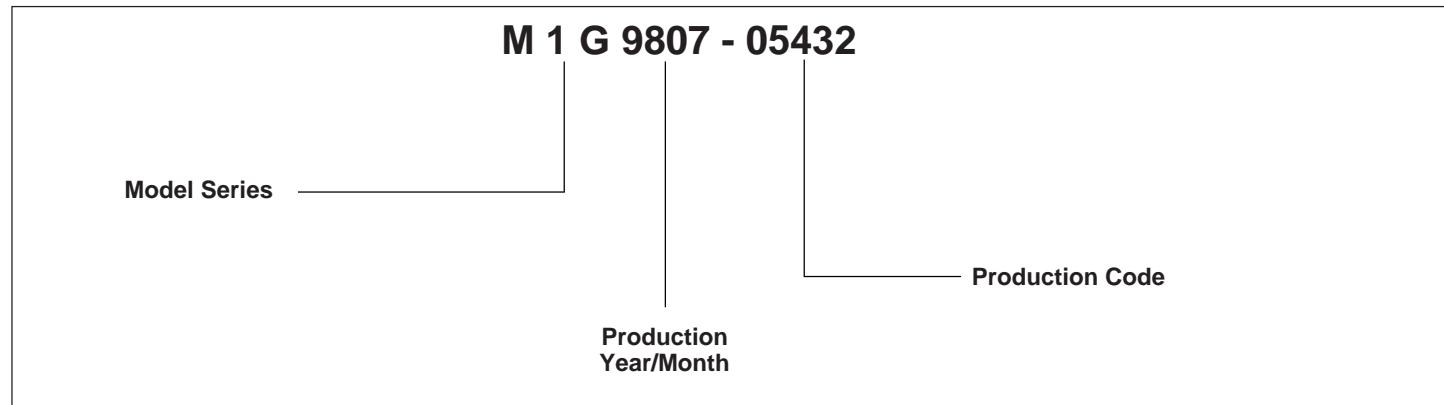
Installations and repairs made by unqualified persons can result in hazards subjecting the unqualified person making such repairs to the risk of injury or electrical shock which can be serious or even fatal not only to them, but also to persons being served by the equipment.

If you install or perform service on equipment, you must assume responsibility for any bodily injury or property damage which may result to you or others. We will not be responsible for any injury or property damage arising from improper installation, service, and/or service procedures.

Model Identification



Serial No. Identification



NOTICE TO INSTALLER

Installer is advised to follow carefully all instructions and warnings in this manual to insure maximum performance, safety, and operating efficiency of these appliances. Improper installation may create hazardous conditions, and will void the appliance warranty.

1. SPECIFICATIONS

GENERAL DESCRIPTION

M1 Series gas and oil furnaces are listed direct vent (sealed combustion), downflow heating appliances for manufactured (mobile) homes, recreational vehicles, and for use in residential/modular/commercial construction. The furnace must be located so that venting can be properly achieved.

"A" cabinet models may be installed with Optional Coil Cabinet Model #911969 for air conditioning.

"B" cabinet models are factory equipped with a built-in coil cavity.

Multi-speed blower assemblies (See Accessories) have been certified for field installation in M1 Series furnaces. An air conditioner can be easily field installed with M1GH Series furnaces if used in conjunction with certified 2-wire relay box, p/n 903092A or 4/5 wire relay box 902898A.

INSTALLATION STANDARDS

Installer shall be familiar with and comply with all codes and regulations applicable to the installation of these heating appliances and related equipment. In lieu of local codes, the installation shall be in accordance with the current provisions of one or more of the following standards.

Furnace Model No	Input MBtu/h	Output MBtu/h	Orifice No		E.S.P. In WC	Pilot Burner	Ignitor Direct	Comb. Blower	Motor Hp	A/C Ready Tons
			Nat.	LP						
M1GH 056	56	45	29	45	0.2	x			1/8	2*
M1GB 056	56	45	29	45	0.3	x			1/3	3
M1GC 056	56	45	29	45	0.3	x			1/2	4
M1GD 056	56	45	29	45	0.3	x			3/4	5
M1GH 070	70	57	24	42	0.3	x			1/5	2½*
M1GB 070	70	57	24	42	0.3	x			1/3	3
M1GC 070	70	57	24	42	0.3	x			1/2	4
M1GD 070	70	57	24	42	0.3	x			3/4	5
M1GH 077	77	60	21	40	0.3	x		x	1/4	3*
M1GB 077	77	60	21	40	0.3	x		x	1/4	3
M1GC 077	77	60	21	40	0.3	x		x	1/2	4
M1GD 077	77	60	21	40	0.3	x		x	3/4	5
M1GH 090	90	70	17	36	0.3	x		x	1/4	3*
M1GB 090	90	70	17	36	0.3	x		x	1/4	3
M1GC 090	90	70	17	36	0.3	x		x	1/2	4
M1GD 090	90	70	17	36	0.3	x		x	3/4	5
M1MA 056	56	46	29	45	0.2		x	x	1/8	2
M1MB 056	56	46	29	45	0.3		x	x	1/3	3
M1MC 056	56	46	29	45	0.3		x	x	1/2	4
M1MD 056	56	46	29	45	0.3		x	x	3/4	5
M1MA 070	70	57	24	42	0.3		x	x	1/5	2½
M1MB 070	70	57	24	42	0.3		x	x	1/3	3
M1MC 070	70	57	24	42	0.3		x	x	1/2	4
M1MD 070	70	57	24	42	0.3		x	x	3/4	5
M1MB 077	77	62	21	40	0.3		x	x	1/4	3
M1MC 077	77	62	21	40	0.3		x	x	1/2	4
M1MD 077	77	62	21	40	0.3		x	x	3/4	5
M1MB 090	90	72	17	36	0.3		x	x	1/4	3
M1MC 090	90	72	17	36	0.3		x	x	1/2	4
M1MD 090	90	72	17	36	0.3		x	x	3/4	5

Electrical Supply - 120 Volts, 60 Hz, 1 Ph.

Fuse or Breaker - 15 Amps.

Temperature Rise - 45° to 75°F

High Altitude - See Table 7.

For Canadian High Altitude (2,000'-4,500'), reduce the gas manifold pressure to 3.0" w.c. for natural gas and to 8" w.c. for LP gas.

Thermostat Circuit - 24 Volts, 60Hz, 30 VAC

Norm. Anticipator Setting - 0.4

Manifold Pressure - Natural Gas - 3.5" w.c. LP Gas - 10" w.c.

*Nominal blower capacity only - relay must be field added.

Table 1. M1 Furnace Specifications

- a. Federal Manufactured Home Constructions & Safety Standard (H.U.D. Title 24, Part 3280.707[a][2])
- b. American National Standard (ANSI-119.2/NFPA-501C) for all recreational vehicle installations.
- c. American National Standard (ANSI-Z223.1/NFPA-54) and/or CAN/CGA B149 for all gas-fired furnace models.
- d. American National Standard (ANSI-Z95.1/NFPA-31) and/or CSA B139 for all oil-fired furnace models.
- e. American National Standard (ANSI-C1/NFPA-70) and/or CSA 22.1 Canadian Electric Code Part 1 for all electrical field wiring.
- f. Units have been investigated under standards UL 307A & B, ANZI 21.47a—CAN/2.3a - 1995, and CSA B140.10.

2. CIRCULATING AIR SUPPLY

RETURN AIR PROVISIONS

U.S.A. home manufacturers shall comply with all of the following conditions to have acceptable return air systems for closet installed forced air heating appliances:

- a. Regardless of the location, the return air opening into the closet shall not be less than specified in the appliance's listing.
- b. Means shall be provided to prevent inadvertent closure by a flat object placed over the return air opening when it is located in the floor of the closet (versus the vertical front or side wall).
- c. The cross-sectional area of the return duct system leading into the closet, when located in the floor or ceiling shall not be less than 235 square inches (or 390 square inches for 5 ton ready M1 Furnaces).
- d. The total free area of openings in the floor or ceiling registers serving the return air duct system must be at least 352 sq. in. At least one register should be located where it is not likely to be covered by carpeting, boxes and other objects.
- e. Materials located in the return duct system must have a flame spread classification of 200 or less. This includes a closet door if the furnace is in a closet.
- f. Noncombustible pans having 1" upturned flanges are located beneath openings in a floor duct system.

HP, Wheel, Poles, Units	Speed	Coil Size	ESP (In. W.C.)	WITHOUT COIL				WITH COIL			
				Low	Med-Lo	Med-Hi	High	Low	Med-Lo	Med-Hi	High
1/8 HP 9 X 7.5 056 - H, A UNITS	1	024	0.1				820				730
			0.2				790				680
			0.3				720				610
			0.4				650				550
			0.5				560				450
			0.6				430				330
1/5 HP 9 X 7.5 066-A 070 - H,A UNITS	1	030	0.1				950				850
			0.2				910				810
			0.3				850				730
			0.4				780				670
			0.5				680				580
			0.6				570				480
1/4 HP 10 x 8 077 - H, B 090 - H, B 086-B UNITS	1	036	0.1				1210				1140
			0.2				1190				1110
			0.3				1140				1050
			0.4				1090				990
			0.5				1030				930
			0.6				970				870
1/3 HP 10 x 8 056 - B 070 - B UNITS	2	036	0.1				1020	1350			960
			0.2				1000	1330			940
			0.3				970	1260			890
			0.4				940	1210			850
			0.5				890	1130			790
			0.6				840	1060			730
1/2 HP 11 X 8 C UNITS	4	047	0.1	890	1070	1270	1480	880	1050	1220	1340
			0.2	880	1060	1260	1460	870	1040	1210	1330
			0.3	860	1020	1220	1400	850	1000	1160	1270
			0.4	840	1000	1180	1350	820	980	1110	1210
			0.5	810	960	1120	1280	800	940	1070	1160
			0.6	760	920	1080	1220	750	890	1010	1090
3/4 HP 10 x 8 4 POLE D UNITS	4	054	0.2	900	1110	1450	1850	870	1070	1420	1700
			0.3	860	1080	1410	1810	840	1050	1380	1650
			0.4	830	1040	1370	1760	820	1030	1350	1630
			0.5	790	1020	1340	1730	780	1010	1320	1590
			0.6	770	990	1320	1700	760	980	1290	1550

Table 2. Blower Performance Data

- g. Wiring materials located in the return duct system shall conform to Articles 300-22 of the National Electrical Code (ANSI C1/NFPA-70).
- h. Gas piping is not run in or through the return duct system.
- i. Test the negative pressure in the closet with the air-circulating fan operating at high speed and the closet closed. The negative pressure is to be no more negative than minus 0.05 inch water column.
- j. For floor return systems, the manufactured home manufacturer shall affix a prominent marking on or near the appliance where it can be easily read when the closet door is open. The marking shall read:
- k. Air conditioning systems may require more duct, register and open louver area to obtain necessary airflow. Use NORDYNE's certiduct program to determine proper duct size for A/C.

Air Distribution Systems

For proper air distribution, the supply duct system must be designed so that the static pressure measured external to the furnace does not exceed the listed static pressure rating shown on the furnace rating plate.

Before installing an air conditioner system, consult home manufacturer for duct system maximum capacity. Location, size, and number of registers should be selected on the basis of best air distribution and floor plan of the home.

! CAUTION:

HAZARD OF ASPHYXIATION: Do not cover or restrict return air opening.

3. VENTING AND COMBUSTION AIR

ROOF JACK SELECTION

Note: Install only Roof Jack Assemblies listed in Table 3 on this heating appliance.

- a. Determine depth of ceiling cavity from center of roof opening to center of ceiling opening. (See Dimension "A" in Figure 1).
- b. Determine ceiling height and subtract height of furnace. (See Dimension "B" in Figure 1).
- c. Add dimensions A + B (and X from Table 3 and Figure 2 if slant deck flashing is used). The total length of (A + B + X) must be within the minimum and maximum range of one of the Roof Jacks listed in Table 3.

ROOF JACK TROUBLE SHOOTING

The roof jack assembly is a telescoping type assembly (see selection) that is made up of a pipe within a pipe construction. The inner pipe (5") is for the flue gases to exit the home. The outer pipe (8") is using the space in-between the 5" and 8" pipe for combustion air. If the furnace is smothering itself out, after a short time, on natural draft models, or pressure switch does not make contact on M1M model, slide up air inlet a few inches and check for debris in pipe. Clean out and check complete flue assembly for blockage. On new homes make sure no building materials fell in the top (air inlet or exhaust). Also remove top and make sure no seams have opened up on roof-jack assembly. On the M1G furnace (natural draft model) the air inlet limit tripping is caused from a unbalanced draft, which means the air inlet becomes a better flue than the flue itself.

Check-out Procedure:

- Is furnace filter clean?
- If furnace is installed in closet, what is the louver open area? The installation instructions state the minimum open area required is 235 sq. in., or 390 sq. in. for 5 ton.
- Inspect roof-jack for internal blockage.
- Inspect inside of upper combustion air box for debris.
- With burner removed, reach inside lower air box into combustion air chute to check for debris (insulation, roofing material, drywall, etc.) and look in the bottom of the heat exchanger for debris.

Model Number	Approx. Length Below Flashing
(F,S)AW(T)1523-(0,2,4)(A,S)	15" - 23"
(F,S)AW(T)2135-(0,2,4)(A,S)	21" - 35"
(F,S)AW(T)2747-(0,2,4)(A,S)	27" - 47"
(F,S)AW(T)3563-(0,2,4)(A,S)	35" - 63"
(F,S)AW(T)5195-(0,2,4)(A,S)	51" - 95"

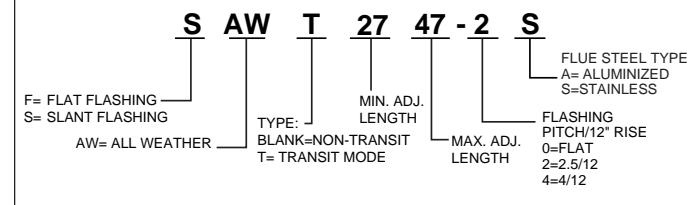


Table 3. Roof Jack Assemblies

- Is gas orifice the proper size for the gas in use?
 - Check manifold gas pressure at low fire (14 seconds nominal) before it steps to normal high fire.
 - The compression fitting on the pilot tube must be tight.
 - Is the burner aligned perpendicular to the burner mounting plate?

APPLICATION OF ALL WEATHER CAPS

In most cases, when a pilot is blown out during windy conditions, an all weather cap will take care of this problem. Extension(s) will also help (see Pilot Outage). See Accessory Chart for part numbers.

All weather caps are used in areas of extreme cold (10° or lower) for long periods of time. This causes ice to form and block combustion air. Replace the standard crown with the optional all weather cap. Follow instructions with the new all weather cap. See Accessories section for part number.

- a. If the roof jack crown is covered or blocked with snow, the furnace will not operate properly. If the home is located in regions where snow accumulation exceeds 7" (HUD snowload zones) use an external roof jack extension p/n 901937.
 - b. M1 furnaces may be used with roof jacks as tall as 170" (except M1M 056 models, which are limited to 120"). Internal roof jack extensions (p/n 901935 - 10", p/n 903107 - 18") can be used to increase roof jack height. All connections inside the home must be made below the ceiling.

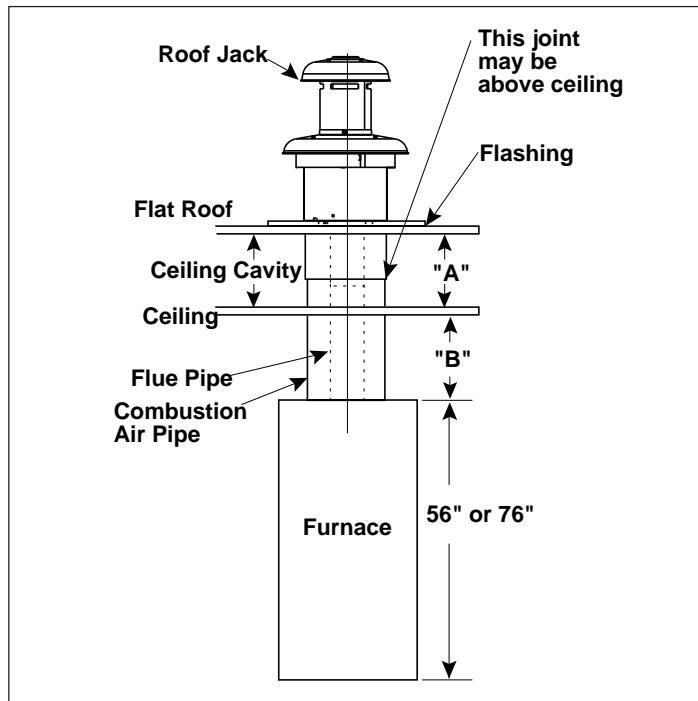


Figure 1. Roof Jack Assemblies

ELECTRICAL WIRING

Line Voltage Wiring (See Figure 15)

The line voltage (115 volt) to the furnace must be supplied from a dedicated circuit containing the correct fuse or circuit breaker for the furnace. See Table 5. An electrical switch should be readily accessible from and within sight of the furnace. All line voltage connections must be made within the junction box located within the furnace.

The furnace cabinet must have an uninterrupted, unbroken ground to minimize injury should an electrical fault condition occur. The controls used in this furnace also require an earth ground to cooperate properly. Acceptable methods for grounding are electrical wire or conduit approved for electrical ground service. Do not use gas piping as an electrical ground.

NOTE: Proper line voltage polarity must be maintained in order for the control system to operate correctly. Verify that the incoming neutral line is connected to the white wire and the incoming "hot" line is connected to the black wire in the furnace junction box. This furnace will not operate unless polarity and ground are properly connected. (See Figure 16).

Never use gas lines as ground.

To determine polarity, the incoming power supply should be checked. The "Hot" lead will read 115V to ground. The "neutral" should read 0V to ground.

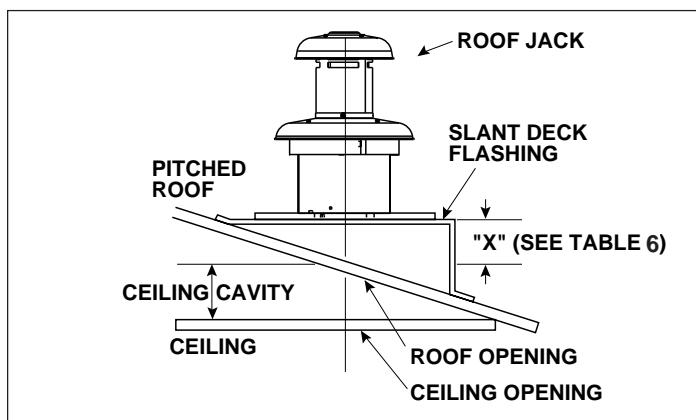


Figure 2.

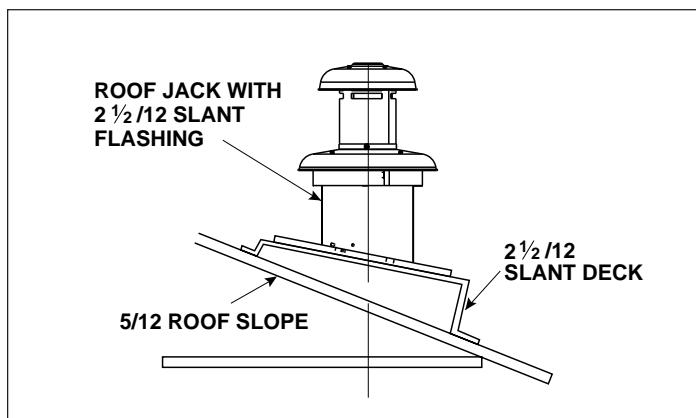


Figure 3.

Supply Voltage

Supply voltage to the furnace should be nominal 115 volts. It must be between 103 volts and 127 volts. Supply voltage to the furnace should be checked with furnace in operation and blower running. Voltage readings outside the specified range can be expected to cause operating problems. Their cause MUST be investigated and corrected.

CONNECT THERMOSTAT WIRES

- Insert 24 volt wires through the plastic grommet just above the control panel.
- Connect the thermostat wires to the furnace low voltage pigtails (see Figure 5).
- Connect low-voltage circuit to the wall thermostat.
- A hole may be made in the furnace cabinet to ease thermostat wiring. Make sure that the wiring is protected from the sharp edge of the added hole.

NOTE: The thermostat should be installed 4 to 5 feet above the floor on an inside wall which is relatively free from direct sources of heat or cold drafts. The nominal anticipator setting is 0.4. (Refer to the thermostat literature for additional information.)

Five-conductor thermostat wire is recommended for 24 volt low-voltage circuit (2-wire is required for furnace only; 5-wire for heating and optional cooling systems).

Once the furnace is installed check the thermostat anticipator against the nominal setting of 0.4:

- Connect the milliamp meter in series with the "W" circuit.
- Energize a call for heat.
- Read the value of the milliamps.
- Adjust the heat anticipator of the thermostat to the value read on the milliamp meter.

If the heat anticipator is set too high the furnace may delay in coming on.

If the heat anticipator is set too low the furnace may cycle frequently and not provide the desired comfort level.

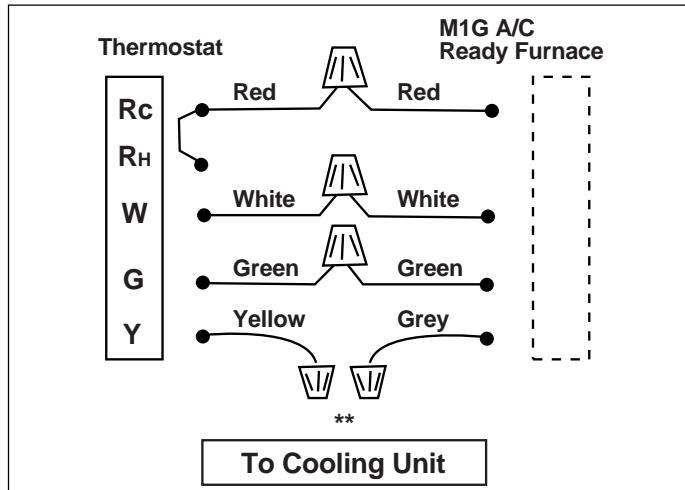


Figure 4. Thermostat Wiring A/C Ready Models

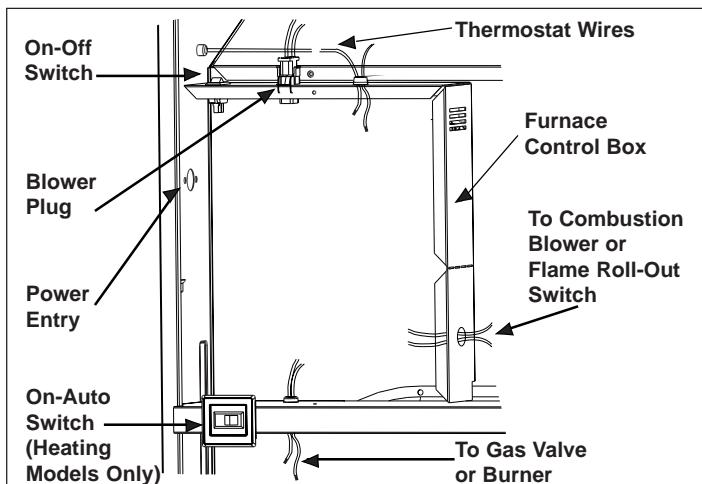


Figure 5. Control Panel (All Models)

T'STAT Wire Gauge	Recommended T'STAT Wire Length (Unit to T'STAT)	
	2-Wire (Heating)	5-Wire (Heating/Cooling)
24	55	25
22	90	45
20	140	70
18	225	110

Table 4. Thermostat Wire Gauge

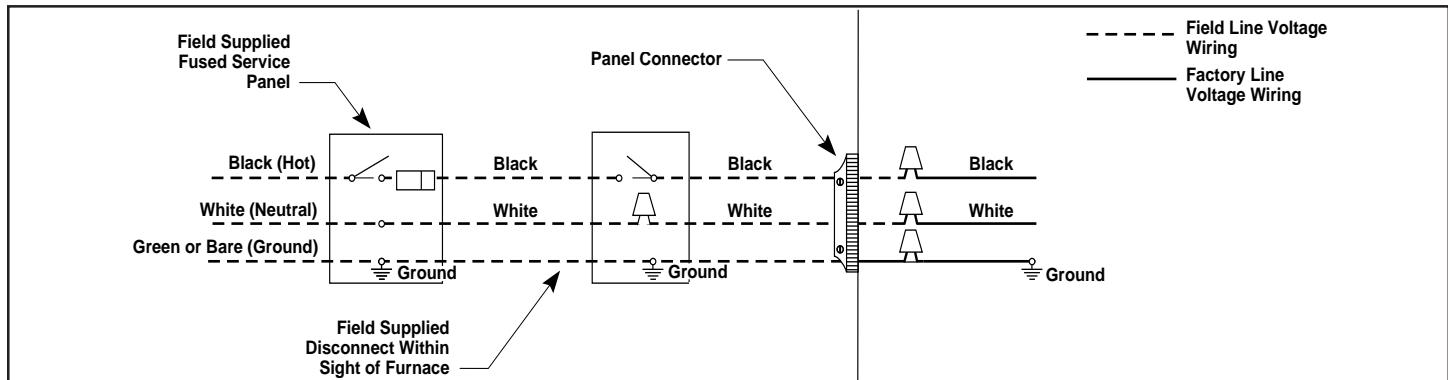


Figure 6. Line Voltage Field Wiring

5. GAS SUPPLY, CONVERSION, AND LIGHTING – M1G AND M1M MODELS

GAS PIPING

Sizing and installation of fuel lines must be in accordance with federal, state and local regulations. All piping shall be black iron pipe, or equivalently sized steel tubing. Internally tinned copper tubing may be used for gas supply systems.

Fuel line installations other than typical installations shown in Figure 7 must comply with the fuel piping provisions stated in the Federal Manufactured Home Standard (H.U.D. TITLE 24, PART 280) and the National Fuel Gas Code (ANSI-Z223.1/NFPA-54).

- a. Optional fuel inlet lines are available for all gas furnace models to permit the addition of a 1/2" F.P.T. shut-off valve above the floor.

NOTE: Shut-off valve must be designed and listed for use with liquid petroleum (LP gas).

The gas supply to your home will either be Natural Gas or LP (bottle gas). Your furnace is factory equipped to operate on Natural Gas. If your gas supply is LP, you must convert the furnace. The necessary instructions for the gas conversion are found on the lighting instruction label attached to the furnace in Section 16, Service Guide.

For natural gas operation, the furnace is designed for 7" W.C. inlet pressure. Pressure is reduced to 3-1/2" W.C. by the pressure regulator in the gas valve. The maximum inlet pressure for the valve is 13" W.C.

For L.P. gas, pressure to the gas valve must be more than 11" W.C. but not more than 13" W.C. Pressure is reduced to 10" W.C. by the pressure regulator in the gas valve.

GAS CONVERSION

This gas fired heating appliance was shipped from the factory for use with natural gas. However, the appliance can be converted for use with LP gas. Use the following procedure for gas conversion of the burner.

ATMOSPHERIC AND DIRECT IGNITION FURNACES

- a. Follow the instructions to "Turn Off Gas to the Appliance."
- b. Disconnect the gas pipe union and the electrical wires connected to the gas valve.
- c. Remove the pilot tube and thermocouple from the gas valve (M1G* only).
- d. To remove the gas valve assembly, remove screw(s) from gas valve bracket. Gas valve and spud may be removed. Orifice is located at the end of the spud (M1G*, M1M*).
- e. Replace the main orifice with the L.P. gas orifice supplied in the envelope located by the gas valve. Check to insure the orifice size matches the nameplate. **NOTE:** For elevations over 2,000 feet, use Table 7 to determine orifice size.

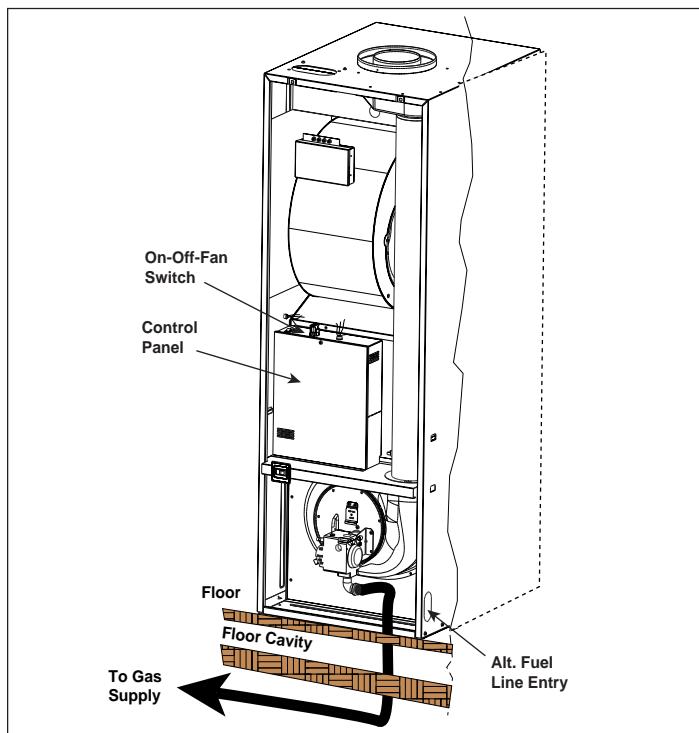


Figure 7. Typical Gas Piping

! CAUTION:
The furnace must be converted by a qualified technician. Improper conversion can cause unsafe operation, explosion, fire and/or asphyxiation.

- f. It is not necessary to convert the pilot orifice.
- g. For Honeywell gas valves with the regulator converter (Figure 8), check for the letters NAT or LP on the pressure regulator cap. Unscrew the cap, invert it, replace, and tighten until snug.
- h. For the Robertshaw gas valve with the regulator converter (Figure 9), remove the black cover and unscrew the converter located on top of the gas valve. Invert the converter. (For "LP" the red ring will be located at the bottom and the "LP" stamping on the converter will appear right side up.) Then screw converter back into the regulator, hand tight plus 1/8 turn, and replace the black cover onto the converter top to protect the threads.
- i. Reassemble the burner assembly into the furnace.
- j. Reconnect the gas piping and electrical wires to the gas valve.
- k. Open the manual shut-off valve and follow the FURNACE START-UP procedure as outlined previously in this manual to put the furnace into operation.

NOTE: The pilot flame is adjustable by turning the adjustment screw located on the gas valve with a small screwdriver. (See Figure 10)

LIGHTING AND FURNACE SHUTDOWN GENERAL-ALL MODELS

Read the safety information on the front page of these installation instructions before lighting furnace. **DO NOT ATTEMPT TO LIGHT FURNACE IF YOU SMELL GAS.**

SAFETY INFORMATION

FOR YOUR SAFETY READ BEFORE LIGHTING.

- a. The first lighting of the furnace after any home setup must be performed by a qualified service technician.
- b. If this appliance has a pilot that must be lit by hand, follow these instructions exactly.
- c. BEFORE LIGHTING smell all around the furnace for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- d. WHAT TO DO IF YOU SMELL GAS: Do not try to light any appliance. Do not touch any electric switch and do not use any phone in your building. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you cannot reach your gas supplier, call the fire department.
- e. Use only your hand to push in the gas control lever. Never use tools. If the lever will not push in by hand, don't try to repair it. Call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- f. Do not use this furnace if any part has been under water. Immediately call a qualified service technician to inspect the furnace and to replace any part of the gas valve or control system which has been under water.

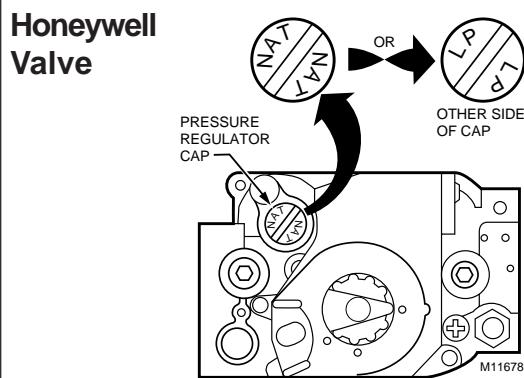


Figure 8. Convertible Pressure Regulator Cap

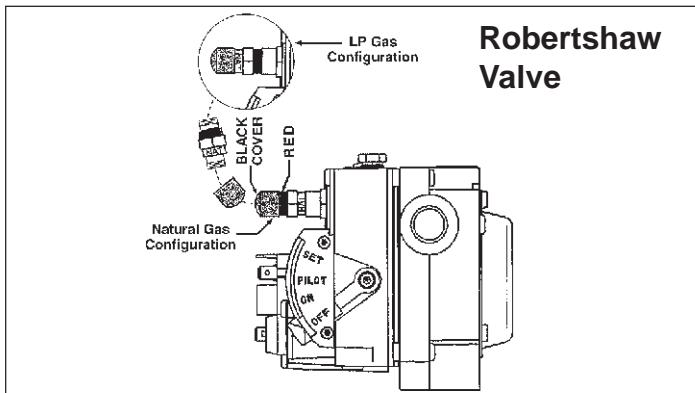


Figure 9. Convertible Pressure Regulator

FURNACE MODEL	ORIFICE SIZE AND OUTPUT CAPACITY	ALTITUDE - FEET									
		SEA LEVEL	2000	3000	4000	5000	6000	7000	8000	9000	10000
M1M/G 056	ORIFICE SIZE - NAT. GAS	29	29	30	30	30	30	31	31	31	32
	ORIFICE SIZE - LP	45	46	47	47	47	48	48	49	49	50
	OUTPUT- MBTUH	45.4	41.8	40.1	38.5	37.0	35.5	34.1	32.7	31.4	30.2
M1M/G 070	ORIFICE SIZE - NAT. GAS	24	25	26	27	27	28	28	29	29	30
	ORIFICE SIZE - LP	42	42	43	43	43	44	44	45	46	47
	OUTPUT- MBTUH	56.7	52.3	50.2	48.2	46.2	44.4	42.6	40.9	39.3	37.7
M1M 077	ORIFICE SIZE - NAT. GAS	21	23	23	24	25	26	27	28	28	29
	ORIFICE SIZE - LP	40	41	42	42	42	43	43	44	44	45
	OUTPUT- MBTUH	61.7	56.9	54.6	52.4	50.3	48.3	46.4	44.5	42.7	41.0
M1G 077	ORIFICE SIZE - NAT. GAS	21	23	23	24	25	26	27	28	28	29
	ORIFICE SIZE - LP	40	41	42	42	42	43	43	44	44	45
	OUTPUT- MBTUH	59.9	55.2	53.0	50.9	48.9	46.9	45.0	43.2	41.5	39.8
M1M 090	ORIFICE SIZE - NAT. GAS	17	18	19	19	20	21	22	23	24	26
	ORIFICE SIZE - LP	36	37	38	38	39	40	41	41	42	43
	OUTPUT- MBTUH	71.7	66.1	63.5	60.9	58.5	56.1	53.9	51.7	49.7	47.7
M1G 090	ORIFICE SIZE - NAT. GAS	17	18	19	19	20	21	22	23	24	26
	ORIFICE SIZE - LP	36	37	38	38	39	40	41	41	42	43
	OUTPUT- MBTUH	69.7	64.2	61.7	59.2	56.8	54.6	52.4	50.3	48.3	46.3

Reference Sources: ANSI Z233.1 & NFPA 54, National Fuel Gas Code.

For Canadian high altitude (2,000 - 4,500'), reduce gas manifold pressure to 3.0" W.C. for natural gas and 9" W.C. for LP gas.

NOTE: Do not attempt to change the size of an orifice by drilling it out. To do so will void the manufacturer's warranty.

Table 7. High Altitude Derate

LIGHTING INSTRUCTIONS FOR STANDING PILOT MODELS

- a. Stop! Read the safety information.
- b. Set the thermostat to the lowest setting.
- c. Turn off all electric power to the appliance.
- d. Push in the gas control lever slightly and move left to "OFF." DO NOT FORCE.
- e. Wait **ten (10) minutes** to clear out any gas. If you smell gas, STOP! Follow step "d" in the SAFETY INFORMATION. If you don't smell gas, go to the next step.
- f. Find pilot - follow metal tube (pilot tube) from gas control valve. Open hinged fire observation door. The pilot is found at the end of the pilot tube, just left of the pilot shield.
- g. Slightly depress the gas control lever and move it right to the "ON" position and release; then move it to the "PILOT" position.
- h. Move the control lever to "SET" and hold. Immediately light the pilot with a match. If this furnace is equipped with a Piezo Ignitor, activate spark lever/button several times until flame is visible through observation door. Continue to hold the control lever for about one (1) minute after the pilot is lit. Release the lever and it will spring back to the "PILOT" position. Pilot should remain lit. If it goes out, repeat steps "d" through "h" above. If the lever does not spring back when released, stop and immediately call your service technician or gas supplier. If the pilot will not stay lit after several tries, move the gas control lever to "OFF" and call your service technician or gas supplier.
- i. Move the gas control lever left to "ON".
- j. Turn on all electric power to the furnace. Set the thermostat to "Heat" and/or the desired temperature setting. Set the On-Off-Fan switch to "ON".
- k. Replace the furnace door.

In the event of any flashback or explosion, immediately shut off the furnace and call your service technician.

TO TURN OFF GAS TO APPLIANCE:

- a. Set the thermostat to the lowest setting.
- b. Turn off all electric power to the appliance at breaker or fuse box, before servicing.
- c. Remove the furnace door.
- d. Push in the gas control lever slightly and move to the left to "OFF." DO NOT FORCE.
- e. Replace the furnace door.



CAUTION:

Do not use matches, lighters, candles or other sources of open flame to check for gas leaks.

Leak Check

After the gas piping to the furnace is complete, all connections must be tested for gas leaks. To check for leaks use only a soap and water solution or other approved method.

NOTE: When pressure testing gas supply lines at pressures greater than 1/2 psig (14 in. water column), the furnace must be disconnected from the gas supply piping system to prevent damage to the gas control valve. If the test pressure is less than or equal to 1/2 psig (14 in. water column), the furnace must be isolated from the gas supply line by closing off the main shut-off valve.

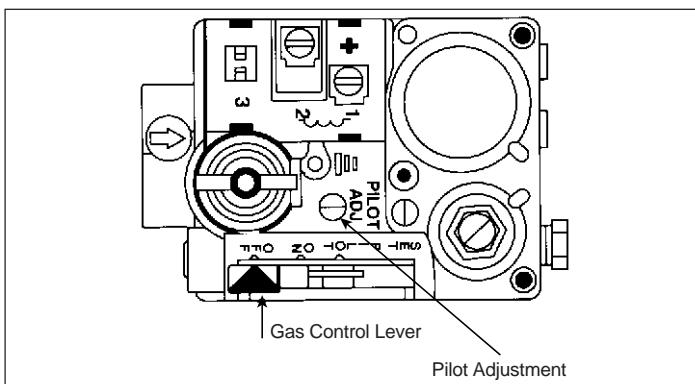


Figure 10. Standing Pilot Valve

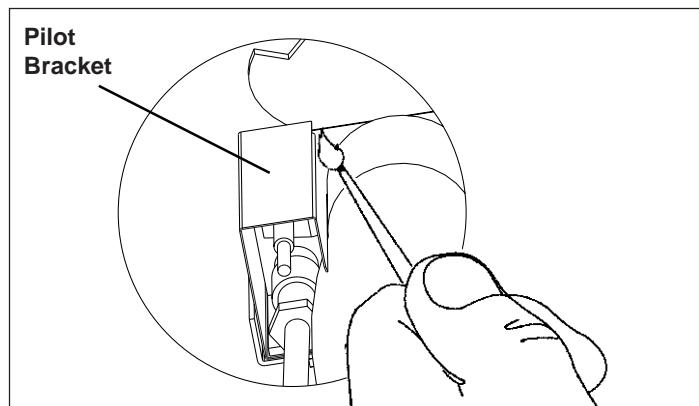


Figure 11. Lighting Furnace

6. ACCESSORIES

Relay Boxes

Only the M1GH requires a relay box. All other M1G and M1M furnaces are AC ready. The M1GH series furnaces are certified to be used with either a 4 wire relay box (p/n 902898A) or a 2 wire relay box (p/n 903092A). Follow the instructions included with the relay box for proper installation.

Cooling Blowers

If you are installing an AC system which exceeds the maximum AC capacity of your system, a larger blower will have to be installed. A blower assembly may also need to be installed for high static pressure applications or crossover systems. Refer to "Blower Data" for further information.

Part No.	Blower / Motor Assembly	A/C Capacity
	Blower Wheel	Ton
903412	10 x 8	1/3
903413	11 x 8	1/2
903414	10 x 8	3/4
		2, 2½, 3 & 4
		2, 2½, 3, 4 & 5

Table 8. Field Installation Blower Assemblies

Fan Timer Kit

The M1G furnace uses a temperature activated switch type fan control (The M1M uses a time delayed control, so this information does not apply). A fan timer kit may need to be installed with this type of switch if the following conditions exist:

1. Very cold outside air temperatures being drawn in through the VentilAire system.
2. Night time thermostat set back to a very low temperature.
3. System is left off for extended periods of time.

The fan may be cycling during a normal call for heat. For gas models, make sure the gas valve is reaching high fire. If there are no problems with the firing rate, install a Nordyne fan timer kit, part number 903490. See instructions with kit for installation. Since many factors outside our control may contribute to blower short cycling, Nordyne does not consider this to be a warranty issue.

Optional Add-On Air Conditioning – Packaged Units

Necessary when the Furnace is Used with Some Central Air Conditioners – If an air conditioner is installed that does not use the furnace blower for air distribution and that operates independently of the furnace, the thermostat system must have an interlock to prevent the furnace and air conditioner from operating at the same time. This interlock system usually contains either a "Heat-Cool" switch which must be turned to the "Heat" or "Cool" position to activate either heating or cooling operation, or a positive "OFF" switch on the cooling thermostat.

The furnace must also be equipped with an automatic damper (See Figure 37 or 38, NORDYNE p/n 901996 for furnaces without coil cavity, or p/n 901083 with coil cavity) to prevent cold air from being discharged up around the heat exchanger. Cold air may cause condensation inside the heat exchanger, which can lead to rust and early failure.

Optional Add-On Air Conditioning – Split Systems

There is a NORDYNE split-system or package air conditioner designed for your total comfort needs. Whether split system or single package, an energy-saving NORDYNE unit is available that has been designed specifically for manufactured housing applications and can best handle your home comfort needs.

Listed and ARI Certified, all models are protected by the NORDYNE Air Conditioner Limited Warranty.

Split system units with vertical discharge for quiet operation connect to the NORDYNE cooling coil furnace (optional coil cavity required with "A" model furnaces).

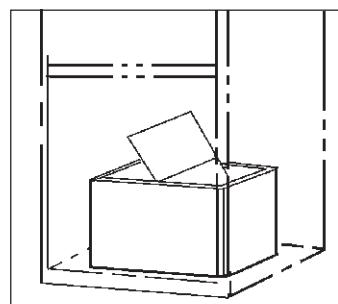


Figure 12. Coil Cavity
Damper

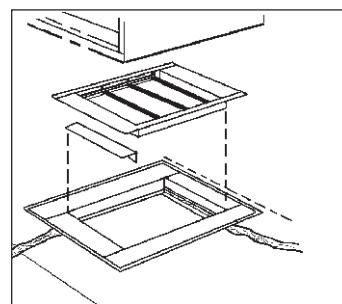


Figure 13. Damper without
Coil Cavity

All Weather Cap - Roof Jack Accessories

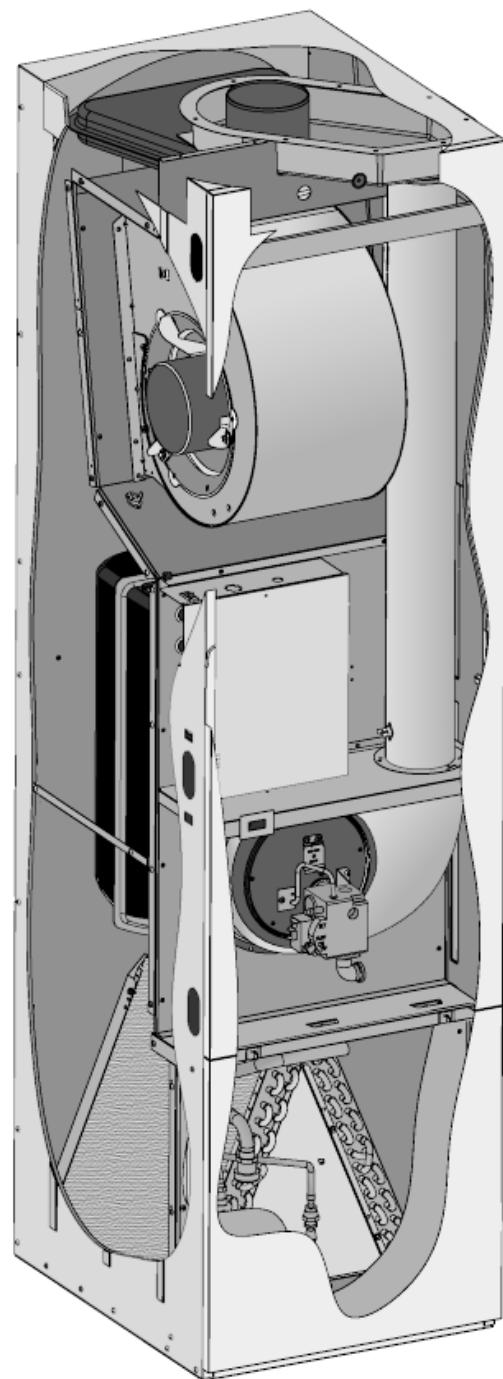
1. In case of high wind or icy conditions, a 903656 all weather cap may be needed. See Pilot Outage section.
2. In regions where snow can accumulate and cover any portion of the roof jack, up to two optional external extensions can be added—part #901937- each 16" long.

Standing Pilot Model M1G Furnace

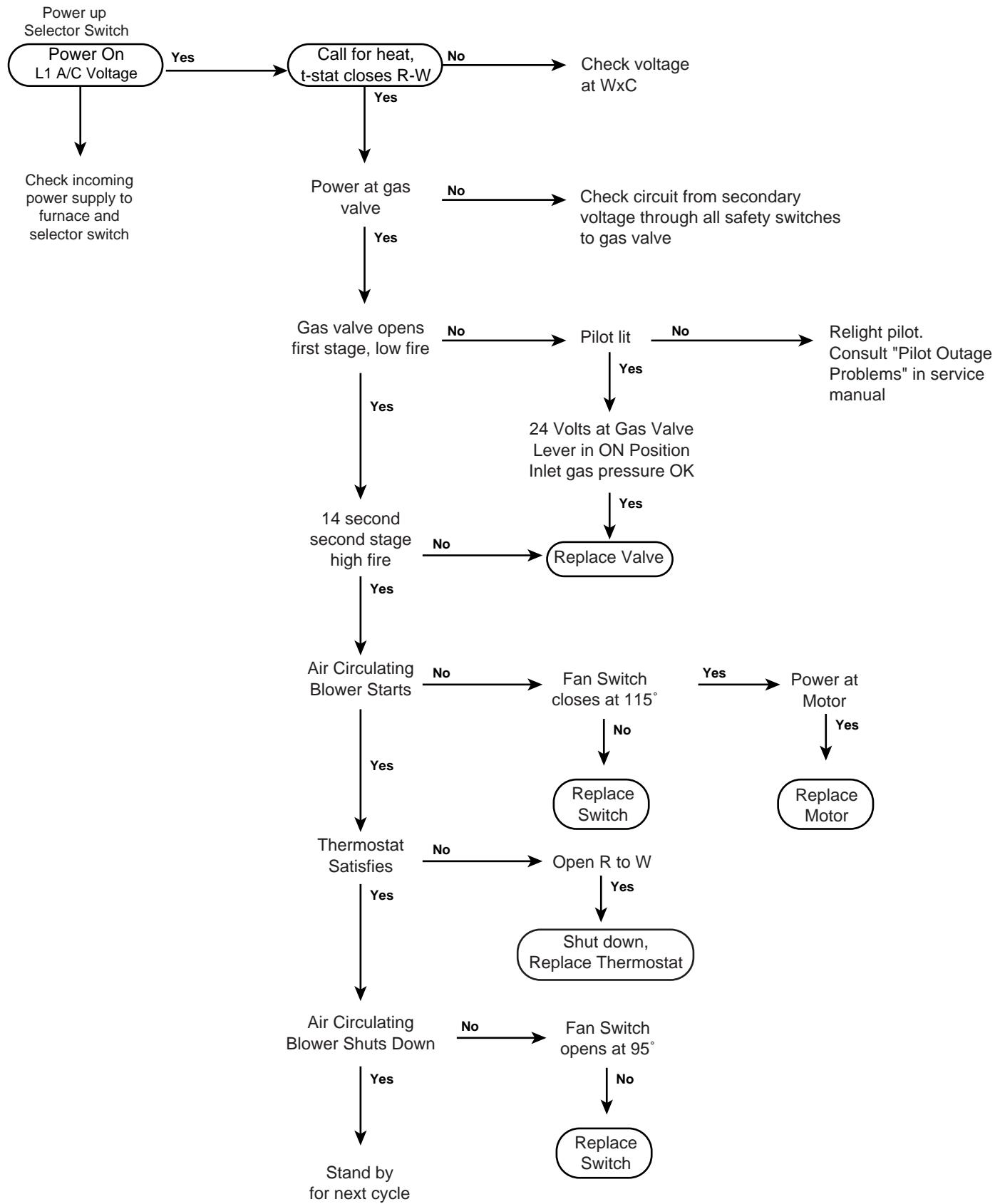
Sequence of Operation

Troubleshooting

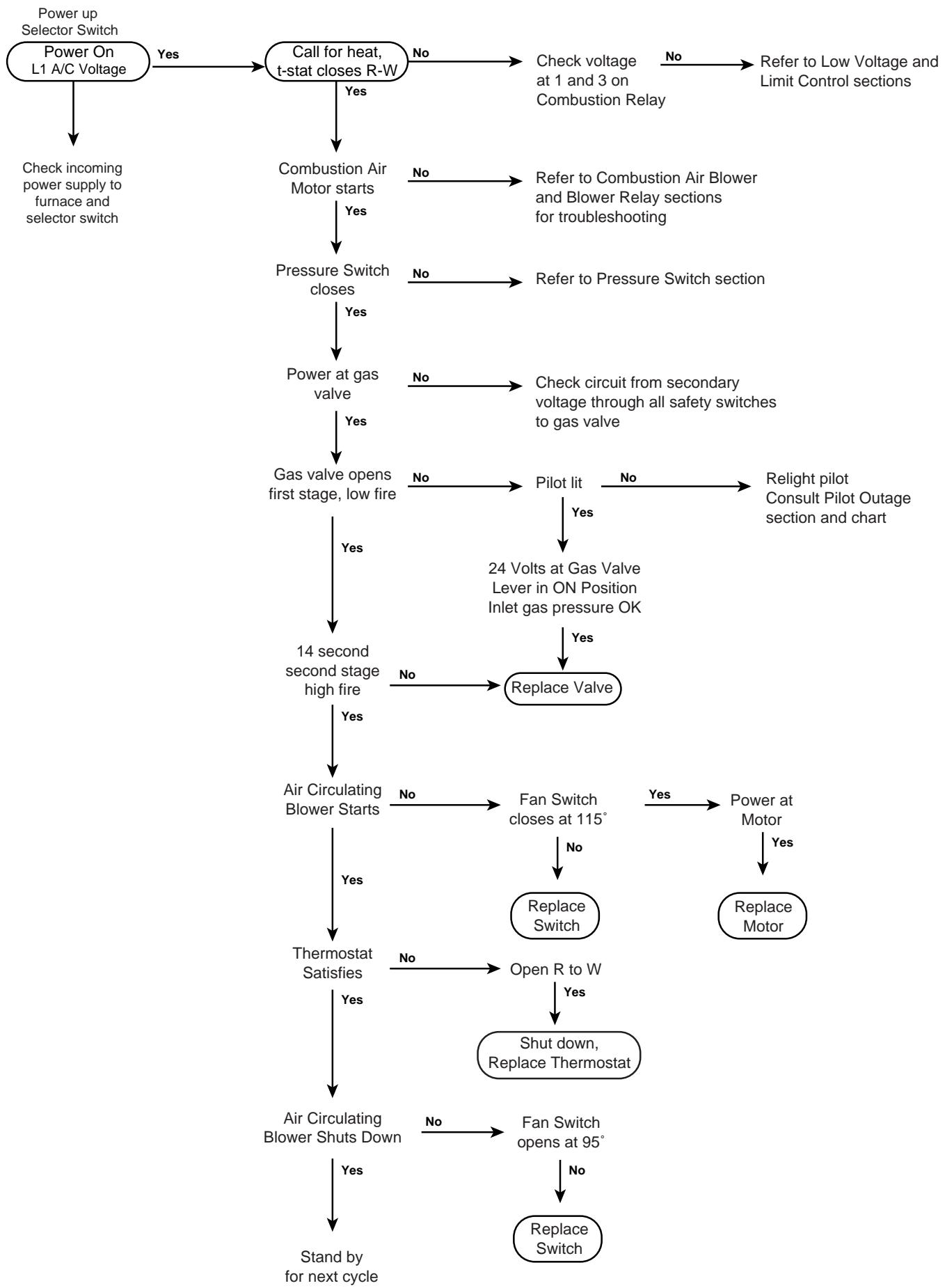
Wiring Diagrams



Troubleshooting Sequence – M1G 056-070



Troubleshooting Sequence – M1G 077-090 Combustion Blower Model



7. Standing Pilot Model M1G

SEQUENCE OF OPERATION FOR STANDING PILOT

- a. On a call for heat, the thermostat contacts close, supplying 24 VAC to the gas valve.
- b. When the gas valve is energized it steps open at a reduced flow and opens fully after approximately 14 seconds.
- c. When the call for heat is satisfied the thermostat contacts open, the gas valve shuts off gas flow.

SEQUENCE OF OPERATION FOR STANDING PILOT W/ INDUCED DRAFT BLOWERS

- a. On a call for heat, the thermostat contacts close, supplying 24 VAC to the relay.
- b. The relay contacts close and energize the induced draft motor.
- c. When the motor reaches full speed the pressure switch closes and energizes the gas valve.
- d. When the gas valve is energized it steps open at a reduced flow and opens fully after approximately 14 seconds.
- e. When the call for heat is satisfied the thermostat contacts open, the gas valve shuts off gas flow, and the induced draft blower stops.

TROUBLESHOOTING

Polarity and Ground

The furnace will not operate if loss of ground occurs. Every effort should be made at the installation to provide a good ground. If old 2-wire romex exists it should be replaced with a 2-wire w/ground. A cold water line could be used provided that the connection or grounding occurs before any di-electric fittings and provided no plastic pipe is used inside or outside the building.

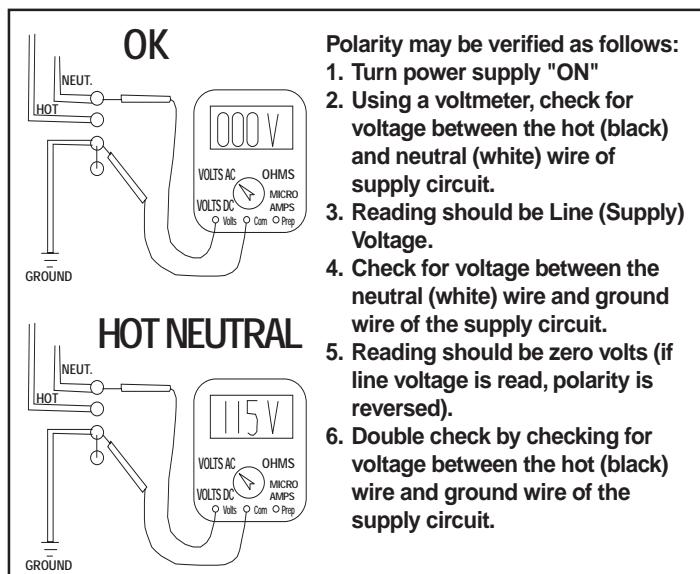


Figure 14. Polarity and Ground

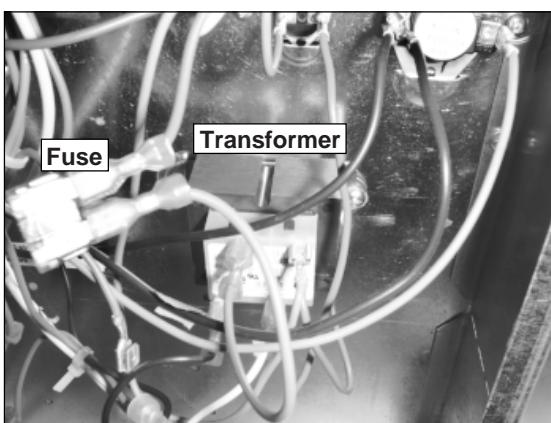
Transformer (Picture 3)

All M1G furnaces are protected by a fuse in the 24 vac circuit. The transformer supplies control voltage (24 vac) by stepping down the supply (primary) voltage from 115 vac to 24 vac (secondary voltage). All M1 transformers are rated at 30 VA. VA is the volt/amp or total wattage the secondary can handle. When a transformer is replaced, the VA should be at least 30 VA, but no more than 40 VA.

Check-out procedure:

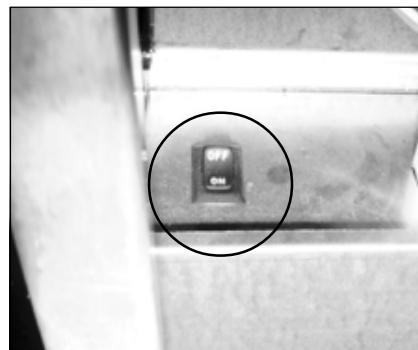
1. Using a volt/ohmmeter on at least 115 vac scale.
2. Measure the voltage at the primary side.
3. If voltage is 115 vac measure the voltage at the secondary terminals marked "24 vac" & "Com" on the transformer.
4. If 115 vac is measured at primary but no voltage is present at "24 vac" & "Com", replace transformer.
5. Fuse will blow if a secondary short occurs.

Transformers open on secondary indicate an overload (a current draw that exceeded rating).



Picture 3. Transformer

On-Off Switch (Picture 4) – This switch turns electrical power to the furnace on and off. The switch must be set in the "On" position for the furnace to operate. For M1G* models, in warm weather there is a possibility of the blower coming on periodically or operating continuously due to a heat buildup within the furnace by a combination of warm weather and heat from the pilot. This is normal operation as long as there is power to the furnace and the On-Off switch is at the "On" position. If blower operation is not desired, the On-Off switch may be set in the "Off" position to cut the electrical power to the furnace.



Picture 4. On-Off Switch

Low Voltage Wiring – Install the thermostat per the manufacturer's instructions. The low voltage (24 vac) connections from the thermostat are made at the terminal strip on the control board in the furnace. See Figure 4 for the proper connections for heating only (two-wire) and heating/cooling (four-wire) applications. The recommended minimum wire gauge for thermostat wiring is shown in Table 4. The thermostat must not be installed on an outside wall or any other location where its operation may be adversely affected. Adverse effects include radiant loading from fireplaces, sunlight, or lighting fixtures, and convective loading from warm air registers or electrical appliances.

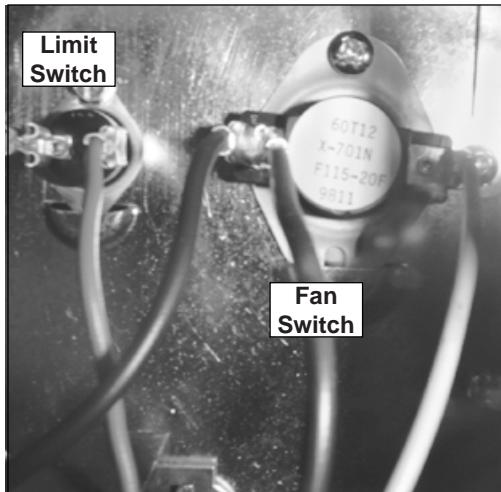
To check the heat anticipator setting:

Jump out R to W at thermostat with 10 Loop Helex and measure current draw after blower starts. Divide by 10. Example: 4 Amps = .4 set at .4.

OR

Set the heat anticipator according to the manufacturer's recommendations.

Limit Control (Picture 5) – This furnace is protected by two high temperature safety limit switches. The auxiliary (upper) limit switch and the high temperature (lower) limit switch are automatic reset types. If either limit trips, the burner will shut off. Check temperature rise and compare to specifications (45° to 75° F)



Picture 5. Fan and Limit Switch

Combustion Air Relay – The combustion air relay is used only on the M1G 077-090. On a call for heat, the relay activates the combustion air motor. The relay is energized through the thermostat from the "W" terminal. It has a 24VAC coil powered by the "W" and Common terminals 3 and 1. Terminals 4 and 2 are normally open contacts.

Combustion Air Blower – The M1G 077-090 model uses a combustion air blower incorporated in series with the air inlet pipe. Its purpose is to supply a forced draft method of combustion air. The quantity of air is determined by the inlet orifice ring, located on the inlet to the motor assembly.

Upon a call for heat under normal conditions, the combustion blower starts up and supplies combustion air to the chamber. If motor does not start, check to be sure call for heat is established. See troubleshooting flow chart and sequence of operation for further details. Then disconnect blower molex plug and check for voltage at plug. If voltage is available and motor does not start replace motor. If power is not available check back through power source and combustion blower relay contacts. See wiring diagram.

Combustion Motor Assembly Replacement

If, using the information from above, you have determined the combustion motor assembly needs to be replaced, use the following procedure:

1. Disconnect Molex plug and pressure switch hoses.
2. Remove screws from the top and break silicone loose from orifice ring on top side of ventor assembly. (See Figure 15). Inlet pipe may also break loose, this is normal.
3. Remove screws from bottom of assembly and remove the whole assembly.
4. Mount new assembly, reattach screws removed in step 3 to bottom. Silicone around bottom, either before or after installation of combustion air blower.
5. Re-silicone orifice ring and combustion air pipe and reinstall screws removed in step 2 to top.
6. Reconnect Molex plug and pressure switch hoses from step 1 and test.

Pressure Switch – The M1G 077-090 uses a differential type pressure switch. The purpose of this switch is to insure that a good supply of combustion air is supplied to the burner. The combustion blower creates a differential in negative pressure (less than atmospheric pressure) across the orifice ring. The switch is normally open and closes on a drop in pressure, read in negative inches of water column.

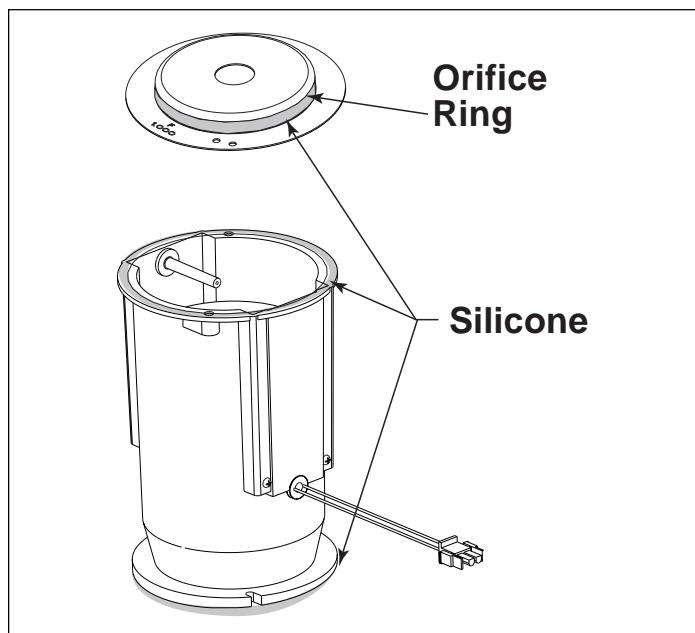


Figure 15. Combustion Air Blower

Under normal operating conditions, once the ventor motor builds up to speed sufficient differential (negative) pressure (approximately -0.30" wc) will be created to close the differential pressure switch and keep it closed the whole heating cycle. Under abnormal conditions, such as ventor motor failure, or restricted air inlet or vent, sufficient differential pressure will not be created.

Pressure switch check out procedure:

1. Remove orange wires from pressure switch. Place tees in the bases connecting pressure switch to combustion blower assembly.
2. Connect a differential pressure gauge (magnehelic or equivalent) to the tees. The magnehelic connection marked low connects to the lower tee, and the one marked high connects to the top tee.
3. Start motor.
4. Negative pressure created by the forced draft motor must be greater than -0.30" w.c. for the switch to close.
5. Use the ohm meter to check for continuity across the switch.
6. If continuity is established, switch has closed. If ohm meter shows infinite reading, and a pressure of -.30" w.c. or higher is present, switch is open, and must be replaced.

If the pressure differential reading will not pull down to -.30" w.c., possible causes could be:

1. Restriction in air inlet pipe, this causes a greater negative at the inlet side connection. This will act to open switch. To prove this, disconnect the hose going to the top connection. If switch closes, there is too much negative pressure being created on the inlet side. Look for air inlet restriction.
2. If there is a heat exchanger restriction or exhaust restriction (any restriction after motor), it will cause a lack of negative pressure. If flow out of chamber (exhaust) is poor no air will be drawn in. Clean chamber and recheck.

3. If motor is not running, no negative will be created and assembly will have to be replaced. (See combustion air assembly replacement)

Burner Assembly – In order to perform procedures such as inspecting for presence of LP gas in chamber, changing the thermocouple, cleaning of pilot and burner, and inspecting the heat exchanger, the burner assembly must be removed.

Changing Complete Burner Assembly

1. Gas Line - Remove the furnace door then disconnect and remove the gas line from the valve body by using two backup wrenches. Be careful not to damage the pipe threads or introduce dirt into the gas line.
2. Wiring Leads - Remove the two low voltage wiring leads from the valve body by carefully pulling them off the connectors. Be careful not to damage or dirty the connector ends.
3. Main Burner Mounting Plate- Using a philips screwdriver, remove the screws that hold the main burner mounting plate to the furnace.
4. Burner Assembly- Slide the burner assembly out from the furnace.
5. Reverse procedure to reinstall.

NOTE: Be sure to install the gasket. If gasket becomes damaged or torn, a replacement gasket kit is available. Contact your distributor for part number.

WARNING:

Before removing burner assembly, shut off all gas supply and electrical power to the furnace at the main shut-off.

Lower (Lesser) Differential Negative Pressure Than Closing Pressure

Insufficient negative pressure measured at the combustion blower may be caused by:

1. Restriction on outlet side of combustion blower (blocked flue or debris building up in flue).
2. Leak (lack of restriction) on inlet side. Inducer inlet leaking, inducer blower props loose or not attached, or wrong restrictor orifice.
3. To test for restriction in outlet pipe (exhaust) to verify problem is outside of furnace, disconnect exhaust for test period only and start furnace. If furnace starts, look for problem in vent pipe. Reconnect after testing.

Higher than normal negative pressure at top connection (acts to open switch) may be caused by:

1. Restricted combustion air inlet pipe.
2. To verify if problem is in inlet pipe, disconnect pressure switch hose at top connection and start furnace. If furnace starts, look for problems mentioned above in inlet pipe. Note: top connection acts to open contacts on differential switch.

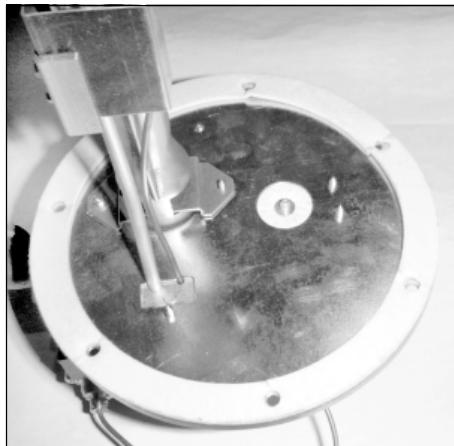
NOTE:

Inlet Pressure - Outlet Pressure = Differential Pressure

Table 9. Lower (lesser) Differential Negative Pressure Than Closing Pressure

Gas Valve - The gas valves for the gas furnaces are a 100% shut-off type and will fail safe if for some reason the gas is turned off. The valve is a "step-open" type for M1G*-models – which means it opens to a "low-fire" position, and after 14 seconds, "steps-open" to "high-fire."

A small orifice is placed in the gas passage to delay the build up of the working pressure. A minimum of two minutes pause time is required between cycles to allow the orifice time to exhaust all working gas from the diaphragm chamber and obtain full dwell time on subsequent cycles. Factory set nominal dwell time is approximately 14 seconds and is *not* field adjustable.



Picture 7. Gasket



Picture 8. Burner Assembly

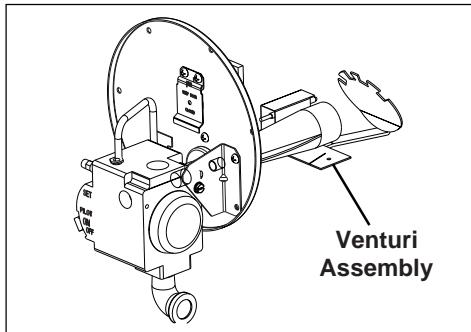


Figure 16. Burner Assembly with Venturi Assembly

Testing Operating Pressure:

- Remove furnace door and set the gas valve in the OFF position.
- Using a 3/16" Allen wrench, remove the plug from the right side of the valve.
- Install the barbed adapter in the plug hole. Tighten by hand at first, then with an open end wrench. Do not overtighten!
- Install the hose and manometer to the barbed fitting. Be sure to check all connections for leaks.
- Light the pilot by following the instructions on the furnace and set the gas valve switch to the ON position.
- With the valve in the ON position, set the thermostat above room temperature so the furnace will run throughout the test procedure.
- With the furnace operating, check for valve staging. The operating pressure should be approximately 3.5" WC for Natural Gas, 10" WC for LP gas.

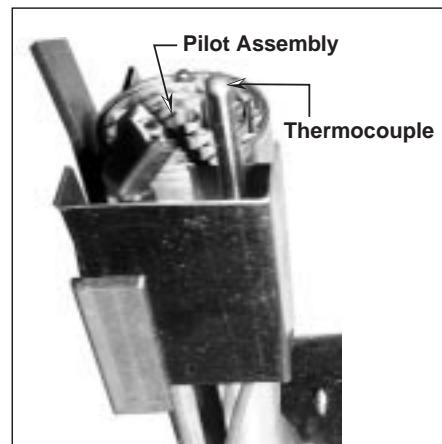
Pilot Assembly, Thermocouple, and Venturi Burner

The pilot lights the main burner. The thermocouple generates around 30 MV unloaded, (unscrewed from valve) and around 15 MV loaded (screwed into valve). See gas valve and pilot outage section for troubleshooting.

The pilot orifice is not changed when furnace is converted to LP (see conversion section). If the flame is more than about 1" in height, it can be adjusted using the pilot adjustment screw. Turn the screw clockwise to decrease the flow rate, counterclockwise to increase it. **Note:** Do not confuse the pilot adjustment screw with the pressure regulator, which increases by turning clockwise and decreases by turning counterclockwise.

To clean pilot or service thermocouple or burner:

- Remove burner.
- Remove pilot assembly screws and pilot shield.
- Remove pilot tube from pilot assembly.
- Inspect pilot assembly - tap out pilot orifice and clean or replace if plugged.
- Replace the pilot tube, shield, assembly screws, and burner. Re-start and test.



Picture 9. Pilot Assembly and Thermocouple

To change thermocouple:

1. Follow the same steps used to remove pilot assembly
2. Remove pilot tube close-off plate by removing the phillips screw on the burner plate.
3. Note the height of the thermocouple in relationship to the pilot before removal. It is critical to use the correct height for reinstallation. Disconnect thermocouple from gas valve and pilot assembly.
4. Slide thermocouple out through hole left after pilot close-off plate was removed.
5. Reinstall new thermocouple and reverse steps from above. Note: Use hand to tighten thermocouple in gas valve, plus 1/4" turn with wrench. Do not overtighten!

Venturi Burner Assembly

The burner assembly consists of the burner, venturi and spreader. If burn through or other burner problem occurs, follow these steps to replace the burner:

1. Follow the steps under changing burner assembly.
2. Disconnect pilot assembly by removing the two screws holding pilot assembly and shield.
3. Remove the two phillips screws holding the burner from the round burner plate. Note that one is removed from the front side and one from the back side.
4. Remove burner and flame spreader assembly.
5. Install the new one by reversing steps 1 through 4.
6. Start up and test.

Gas Valve Replacement

1. Turn off gas and electric.
2. Disconnect the two low voltage wires.
3. Disconnect pilot tubing and thermocouple from gas valve.
4. Remove the two screws from the gas valve mounting plate.
5. Remove gas valve and remove gas valve mounting.
6. Remove spud holder threaded into valve.
7. Repipe dope spud holder and tighten into new valve.
8. Reverse steps through 5 and test.

Fan Switch (Picture 5) – The fan switch is a temperature actuated, normally open switch that closes on temperature rise and is in series with the heating speed of the air circulating blower. Upon a call for heat, and when the burner builds up a supply of heat, the fan switch wraps closed at 115° ($\pm 5^\circ$) and blower motor starts. After the thermostat opens and the chamber cools down, the fan switch opens at 95° ($\pm 5^\circ$) and blower shuts off.

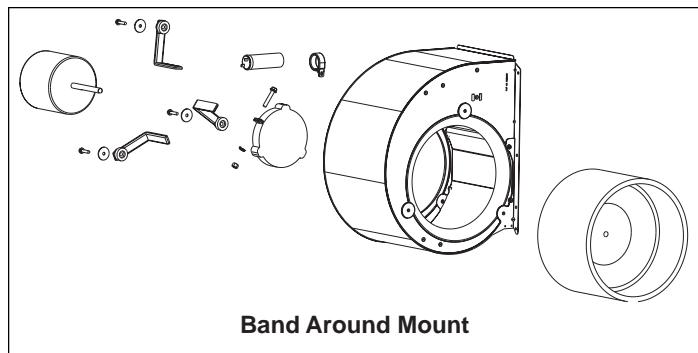
If blower does not start after warm up, check blower for power. If blower has power, see Blower Checkout section. If blower does not have power, check for line voltage across the fan switch. If voltage is present the switch is open. You also can remove wires, and ohm out after warm up. **NOTE:** Use tape to make sure wires do not touch anything. An infinity reading indicates the switch is open.

If blower motor does not shut off and chamber has cooled (and fan switch is off), check across fan switch contacts. If there is no voltage, pull the single orange wire off (take care not to touch uninstalled terminal or lay wire against metal). If blower shuts off, fan switch is stuck closed. If switch does not close or open properly, it will have to be replaced. Turn off power, remove wires, and remove the two phillips screws to remove switch. Install new switch and re-test.

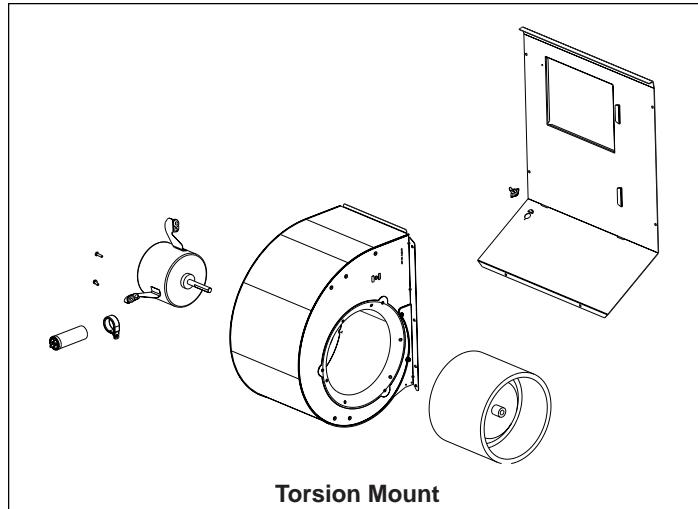
Blower Assembly (Picture 10) – If the blower motor has power to it (heating speed and neutral) and motor does not start, motor has electrically opened up. **NOTE:** Some models incorporate a capacitor, this should be checked first.

To replace motor:

1. Remove wires going to motor.
2. Remove Phillips screw(s) on left side.
3. Raise entire blower assembly slightly and swing out to left.
4. Loosen set screw on blower hub.
5. Remove screws holding motor to blower housing.
6. Remove motor and replace. **NOTE:** Some motors are torsion-flex mount and some are band around mount. See picture below.
7. Reverse steps 1-5 to reinstall. Note: Be sure to tighten blower set screw on flat of motor shaft.



Band Around Mount



Torsion Mount

Picture 10. Blower Assemblies

Heat Exchanger Replacement – The heat exchanger is the largest and most expensive item in the furnace. Before replacing the heat exchanger, make certain it is the problem. Call the technical service department if you have any uncertainty about a heat exchanger failure. **Heat exchangers can become sooted up due to debris in top of furnaces, improper conversion, or not being converted to LP. See troubleshooting section on flue and conversion section of this manual. This condition is not covered under warranty.**

To Test Heat Exchanger:

Several methods may be used to test, or inspect for heat exchanger flaws.

1. Remove the blower and burner. Visually inspect the heat exchanger with a mirror. If you find a crack or hole in any part of the heat exchanger, replace without delay.
2. When the blower starts, observe the flame. If there is a disturbance in the flame, inspect and determine the cause.
3. Using a CO detector from the nearest register, monitor the level for an increase while the unit runs. Single digits of CO are common, but cigarette smoke, etc. can have an impact on the level. A rapid increase in the CO level while the furnace is running is not normal. If this occurs inspect the heat exchanger.

Note: The furnace does not have to be removed from its alcove to replace the heat exchanger. Be sure to order the replacement gasket kit along with the heat exchanger. It contains all gaskets used in the furnace.

Change Out Procedure:

1. Disconnect all gas and electrical power to furnace.
2. Disconnect flue.
3. Remove burner assembly.
4. a. M1G-056-070 Only: Remove combustion air pipe.
b. M1G-077-090 Only: Remove combustion air pipe and combustion blower.
5. Remove blower assembly.
6. Remove blower deck panel. **NOTE:** Panel will be difficult to remove with furnace in alcove.
7. Remove front panel. **NOTE:** One of the panel screws is located through the combustion air box on the right.
8. Lift up divider panel out of side cabinet lances.
9. Support the underside of the heat exchanger with a board.
10. Remove top collector panel. **NOTE:** Two screws attach through top of cabinet.
11. Remove the other eight screws in the top of the cabinet that hold the combustion air box.
12. Remove heat exchanger and replace.
13. Reverse steps one through eleven to reinstall.
NOTE: Be sure to install all new gaskets (from gasket replacement kit).
14. Start up and check out for proper operation.

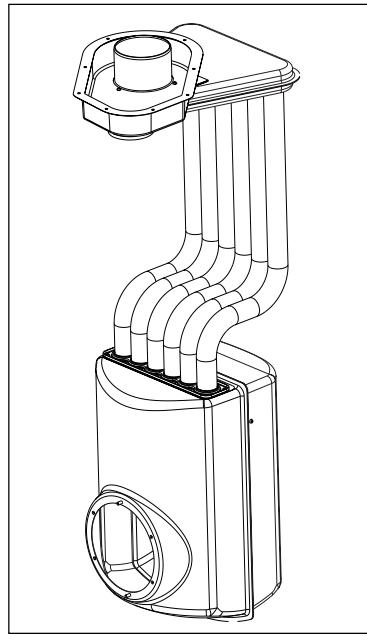


Figure 17. Heat Exchanger

Roll Out Switch - (M1G* - 056 & 070) The furnace is protected by a manual reset safety switch located on the bottom left hand side of the combustion pipe. A draft imbalance or improperly staging valve can cause this switch to open up. Check for poor draft or blockage in the heat exchanger to correct draft imbalance.

Pilot Outage – Pilot outage can occur because of either a mechanical (internal) or environmental (external) problem. The frequency and conditions that exist will be important information in solving a pilot outage problem. Most mechanical problems will result in a situation where pilot can not be lit at all or goes out with the first cycle or shortly thereafter. The environment around the furnace or home will be trickier to diagnose and usually will have infrequent occurrences of pilot outage, such as once a week, only on windy days etc. Since most pilot outage problems fall under one of these two situations our troubleshooting will be divided up into these two areas. See Pilot Outage chart, next page.

Pilot Outage Chart

Mechanical (Internal to Furnace)		
Problem	Possible causes	Solutions
1. No pilot Flame	No inlet gas pressure. Plugged pilot orifices.	Check sources. Clean or replace orifices.
2. Pilot lights with button held, but goes out when released.	Pilot not contacting 3/8" to 1/2" top of thermocouple. Thermocouple burned through. Check for proper millivolts - see thermocouple section for procedure.	Clean and or adjust pilot. Check inlet gas pressure. Replace thermocouple if defective. Millivolts OK-Replace gas valve.
3. Pilot lights OK, goes out when main valve comes on or shortly thereafter	Gas valve not staging or too high inlet gas pressure. Restricted air inlet or exhaust pipe. No baffle prior to April, 1999.	Replace valve, lower gas pressure at regulator or house. Clean out any debris. Install baffle kit. 903722
4. Pilot goes out when main valve comes on or shortly after, but only on cold start-up- first cycle only.	Gas valve not staging.	Replace gas valve.
5. Pilot lights OK, goes out when gas valve closes (pulled out)	Gas valve closing improperly Pilot dirty or needs adjustment	Replace valve Adjust or clean pilot

Environmental (external to furnace)

Problem	Possible causes	Solutions
1. Goes out only when its windy or Barometric pressure drops suddenly	Roof jack termination too close to roof line, causing downdraft. Standard crown.	Install optional extension kit to take both inlet and exhaust above roof peak. Install optional all weather cap. 903656
2. Goes out only when it snows	Roof Jack termination too low, covering inlet	Install optional extension kit 901937
3. Goes out only in zero or sub-zero weather	Ice forms around air inlet and blocks off combustion air	Install all weather cap. 903656
4. Conditions are such that pilot will not stay lit.	All the above have been tried with no resolution.	Install optional HSI conversion kit. 903428

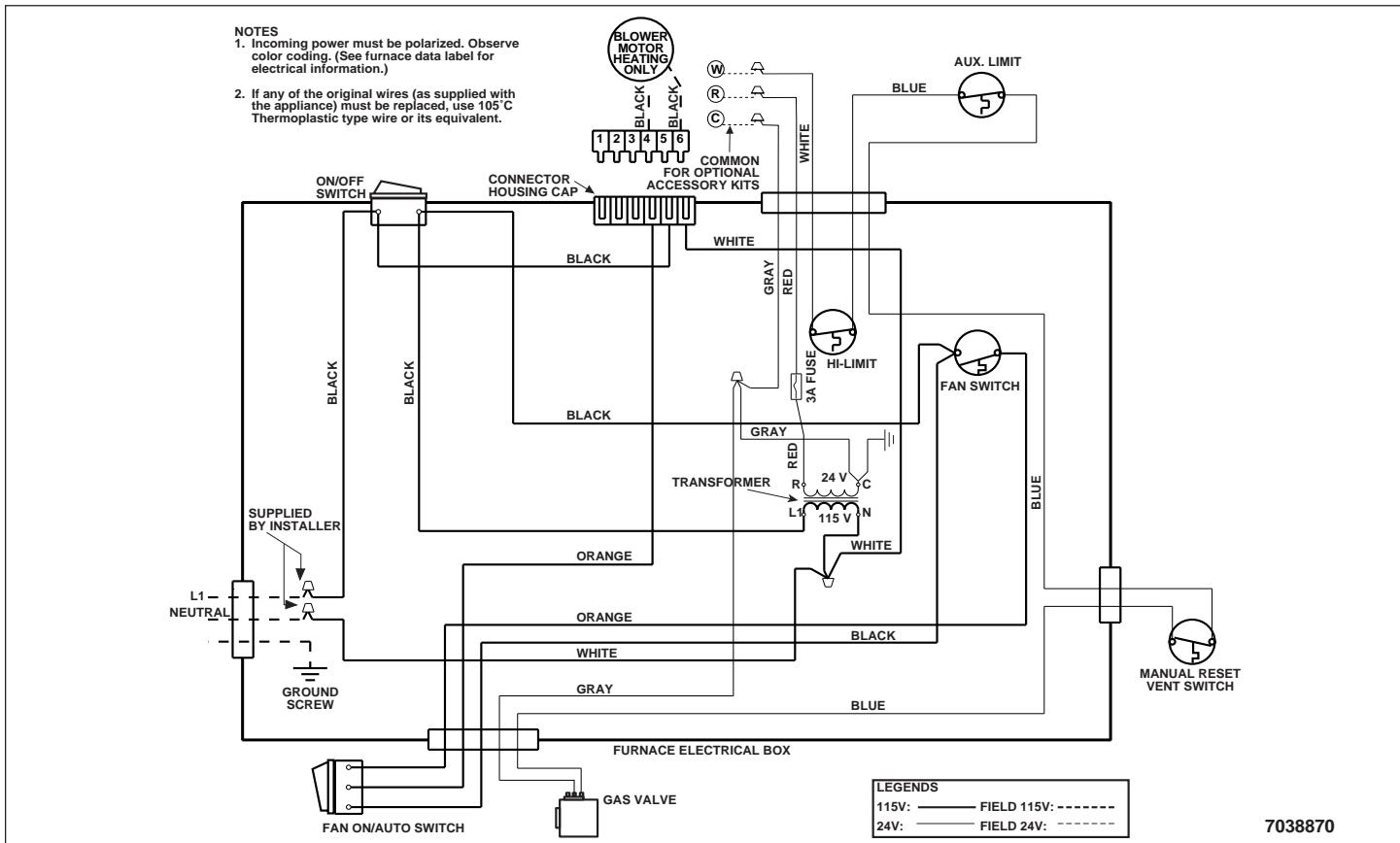


Figure 18. Gas Atmospheric Furnace, M1GH 056, 070 Models

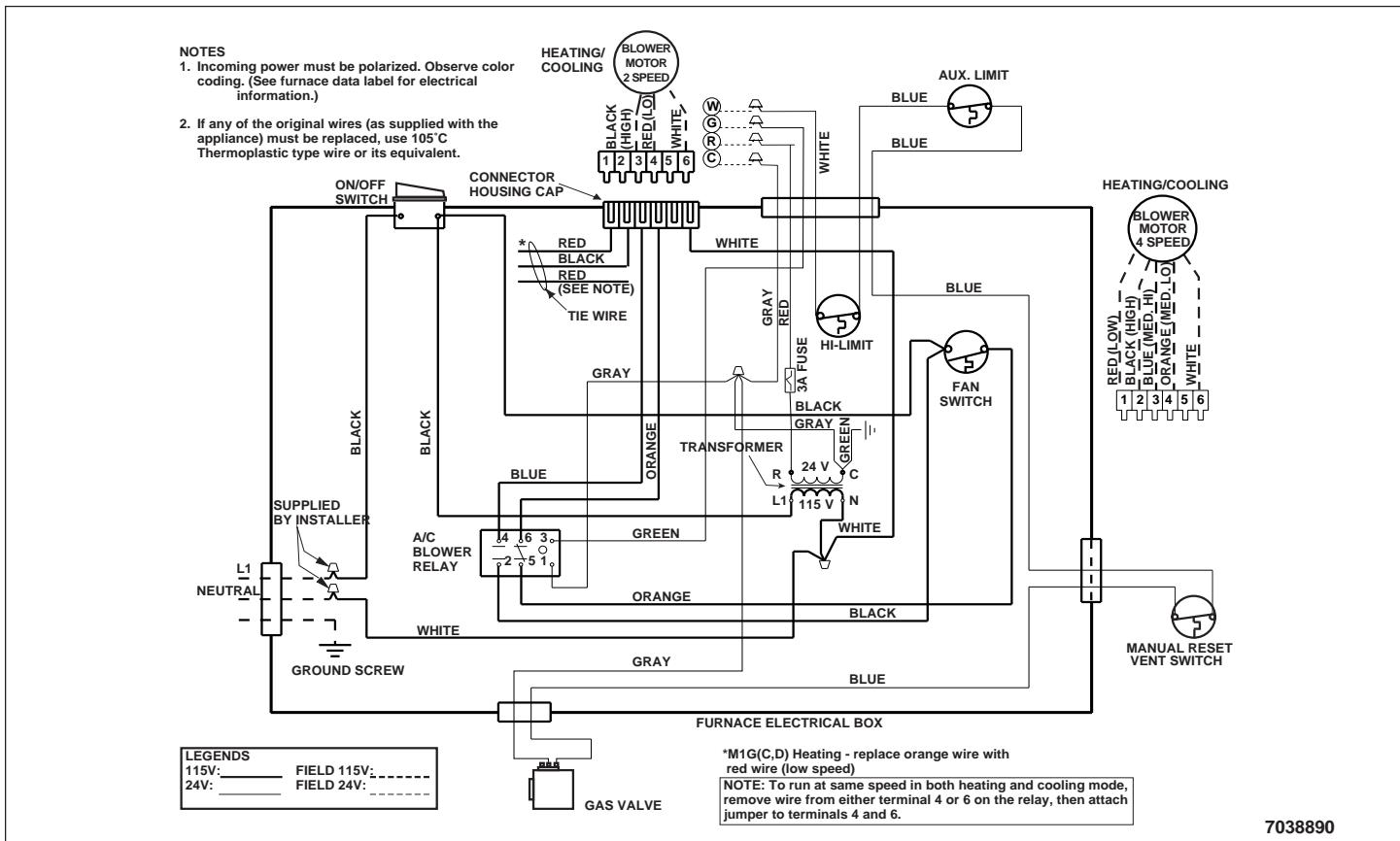


Figure 19. Gas Atmospheric Furnace, A/C Ready, M1G (B, C, D) 056, 070 Models

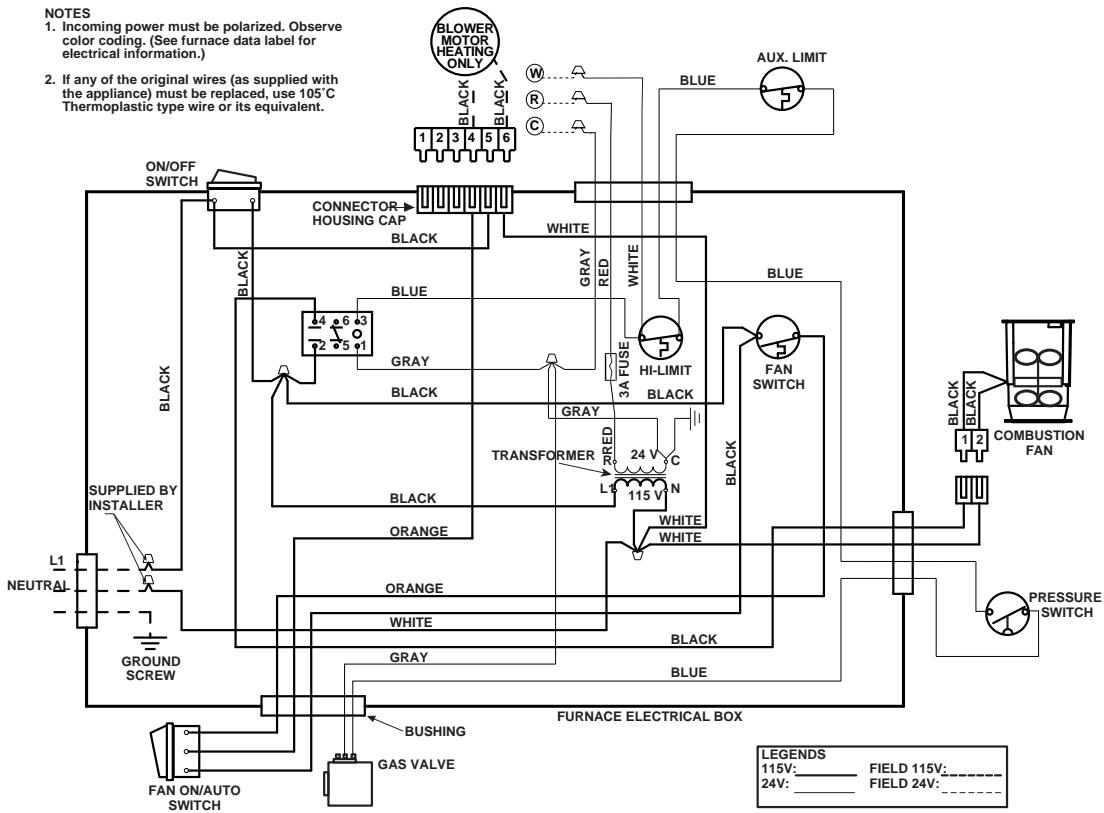


Figure 20. Standing Pilot with Induced Draft Furnace, M1GH 077, 090 Models

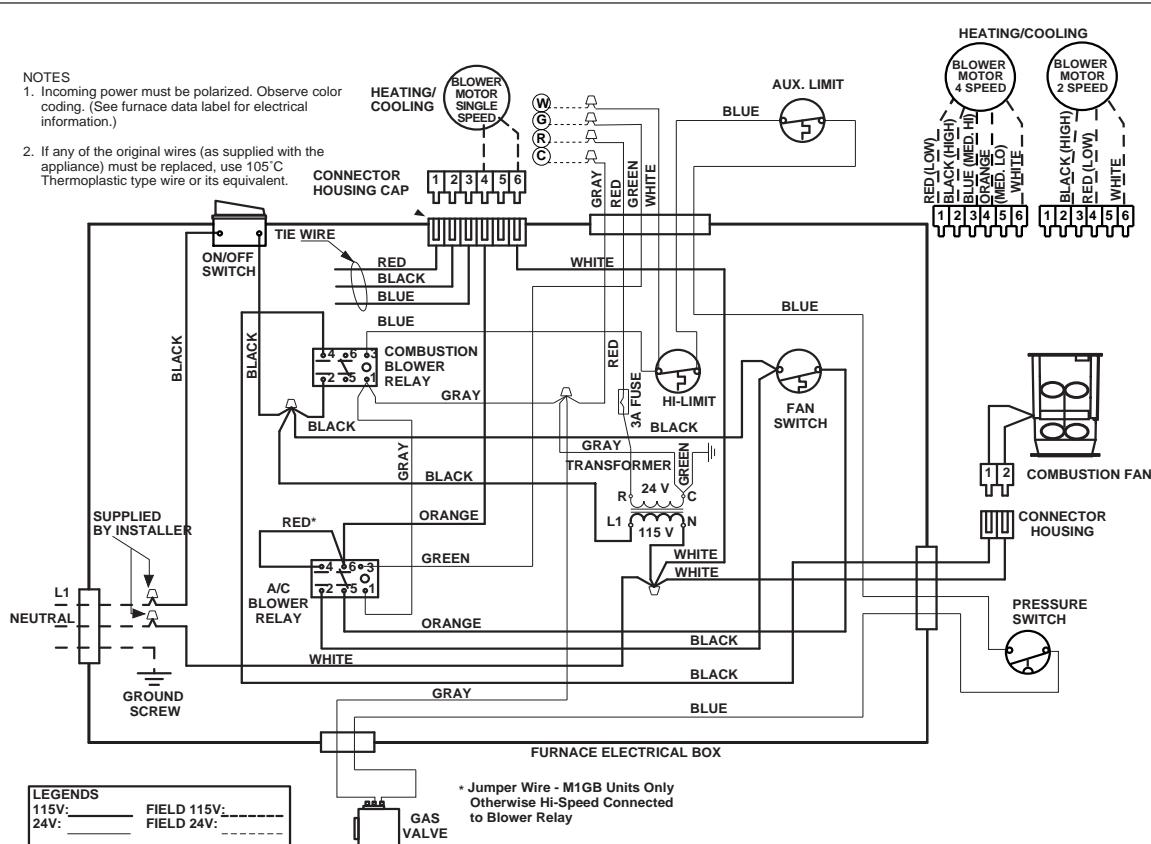


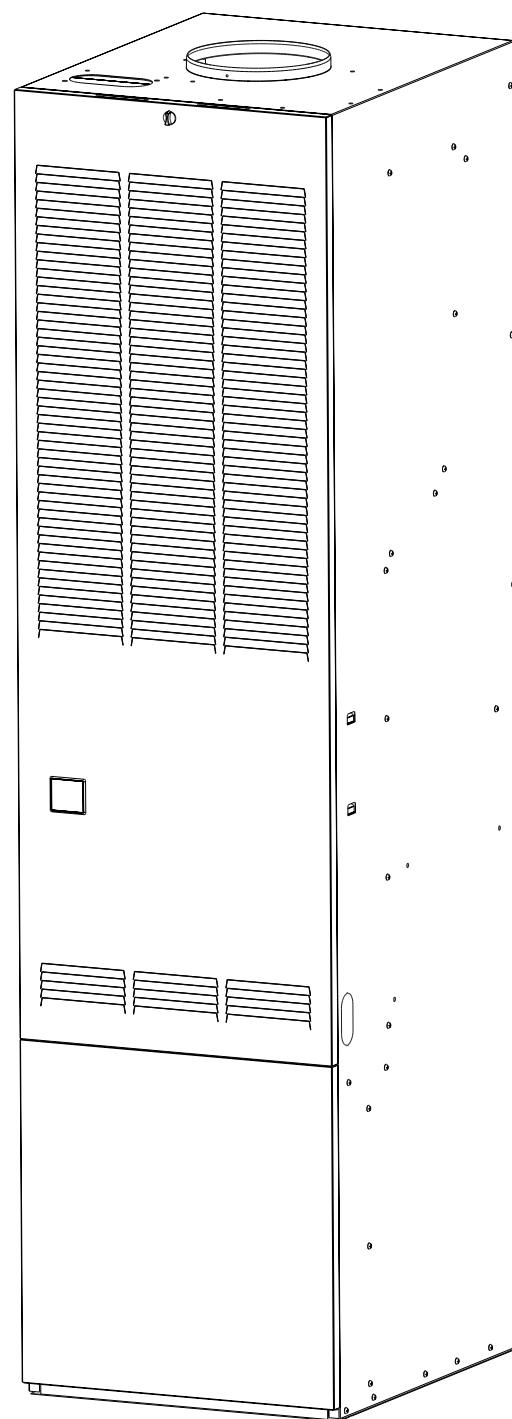
Figure 21. Standing Pilot with Induced Draft Furnace, A/C Ready M1G (B, C, D) 077, 090 Models

Hot Surface Ignition System Model M1M Furnace

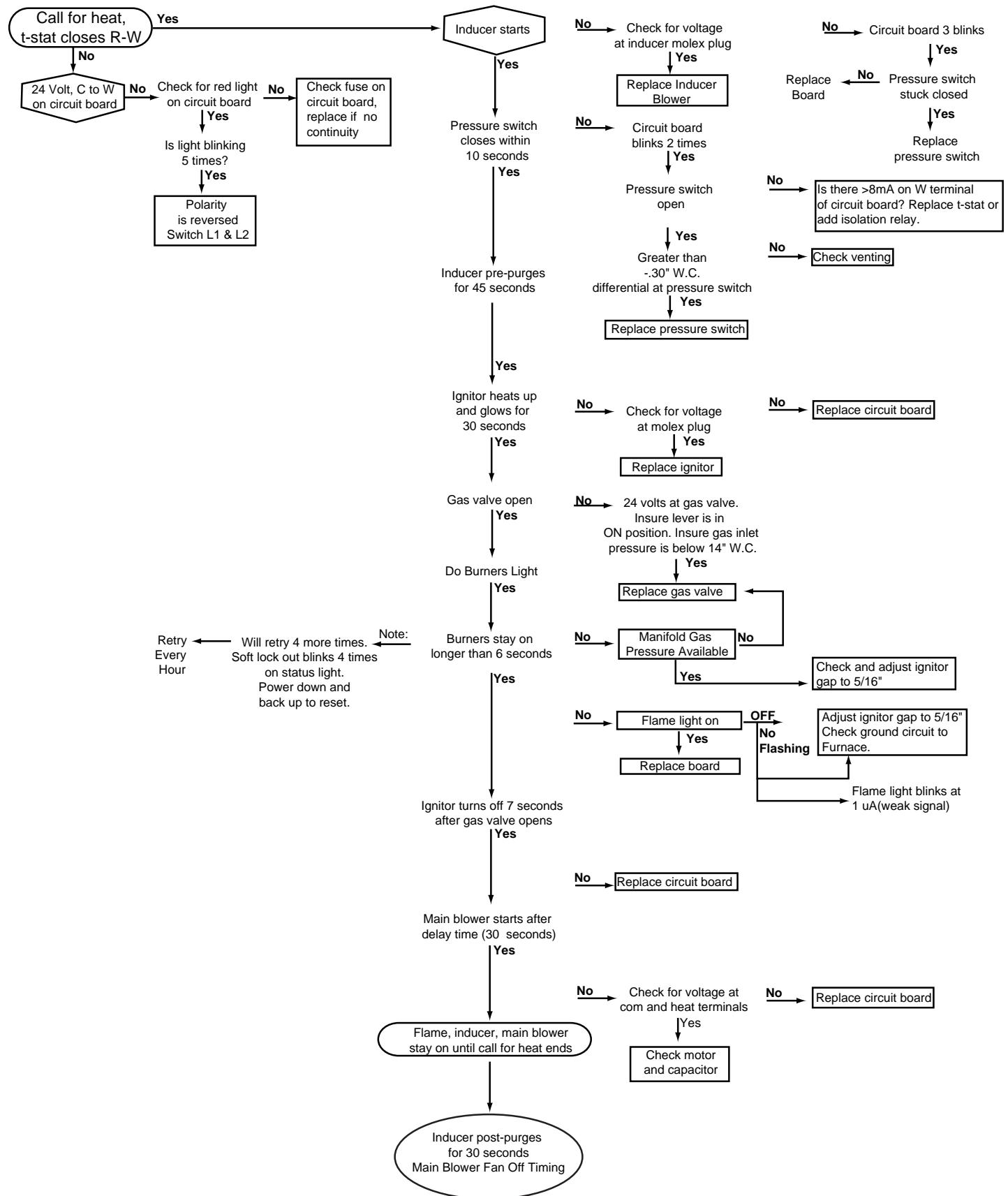
Sequence of Operation

Troubleshooting

Wiring Diagrams



Troubleshooting Sequence – M1M



8. Hot Surface Ignition System Model M1M

SEQUENCE OF OPERATION M1M SERIES

Call for heat: the thermostat calls for heat by energizing the "W" terminal. The control checks to see the pressure switch is open. If the pressure switch is closed when the call for heat occurs, the control will begin to flash "3" on the Status LED after 10 seconds and wait indefinitely for the pressure switch to open.

Pressure switch proving: the control energizes the induced draft motor and waits for the pressure switch to close. If the pressure switch does not close within 10 seconds of the inducer energizing, the control will begin to flash "2" on the Status LED and wait indefinitely for the pressure switch to close.

Pre-purge: the control runs the inducer for a 45 second pre-purge time.

HSI warm up: the control energizes the HSI for 30 seconds. The inducer remains energized.

Ignition activation period: the control energizes the main gas valve for 6 seconds. The inducer and HSI remain energized.

Flame proving: the control de-energizes the hot surface ignitor. The gas valve and inducer remain energized. If flame is present 1 second after HSI de-energizes, the control goes to blower on delay. If a flame is not present, the control de-energizes the gas valve and proceeds with ignition retries as specified below.

Blower on delay: If flame is present, the control energizes the blower on HEAT speed 30 seconds after the gas valve opened (24 seconds from HSI off). The gas valve and inducer remain energized.

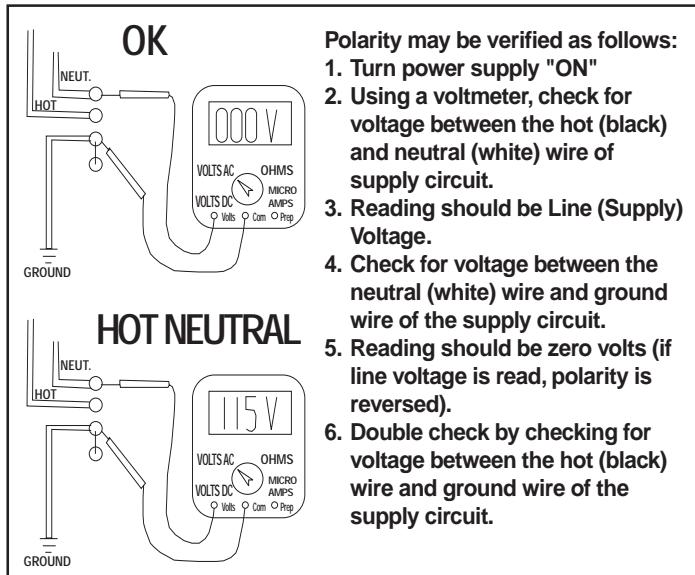


Figure 22. Polarity and Ground

Steady heat: Control inputs are continuously monitored to ensure limit and pressure switches are closed, flame is established, and the thermostat call for heat remains.

Post purge: When the thermostat demand for heat is satisfied, the control de-energizes the gas valves. The inducer output remains on for a 30 second post-purge period.

Blower off delay: The indoor blower motor is de-energized after a 120 second blower off delay. Blower timing begins when the thermostat is satisfied.

COMPONENT PARTS

TROUBLESHOOTING

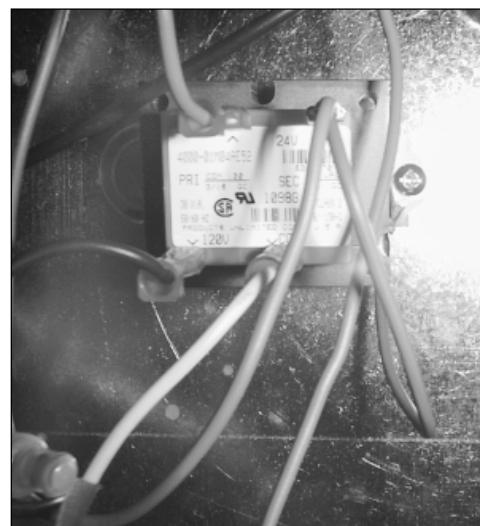
Polarity and Ground

The furnace will not operate if loss of ground occurs. Every effort should be made at the installation to provide a good ground. If old 2-wire romex exists it should be replaced with a 2-wire w/ground. A cold water line could be used provided that the connection or grounding occurs before any di-electric fittings and provided no plastic pipe is used inside or outside the building.

Transformer (See Figure 21) – The transformer supplies control voltage (24 vac) by stepping down the supply (primary) voltage from 115 vac to 24 vac (secondary voltage). Transformers are rated by VA. VA is the volt/amp or total wattage the secondary can handle. When a transformer is replaced the VA should be of an equal or greater value.

Check-out procedure:

1. Using a volt/ohmmeter on at least 115 vac scale.
2. Measure the voltage on the control board terminals "XFMR" & "NEUTRAL".
3. If voltage is 115 vac measure the voltage at terminals marked "24 vac" & "Com" located in the center of the control board.
4. If 115 vac is measured at "XFMR" & "NEUTRAL" but no voltage is present at "24 vac" & "Com" replace transformer.



Picture 11. M1M Transformer

Transformers open on primary indicate low voltage short circuit. Transformers open on secondary indicate an overload (a current draw that exceeded rating).

Low Voltage Wiring

Install the thermostat per the manufacturer's instructions. The low voltage (24 vac) connections from the thermostat are made at the pigtail wires coming off the control board in the furnace. See Figure 23 for the proper connections for heating only (two-wire) and heating/cooling (four-wire) applications. The recommended minimum wire gauge for thermostat wiring is shown in Table 5.

The thermostat must not be installed on an outside wall or any other location where its operation may be adversely affected. Adverse effects include radiant loading from fireplaces, sunlight, or lighting fixtures, and convective loading from warm air registers or electrical appliances.

To check the heat anticipator setting:

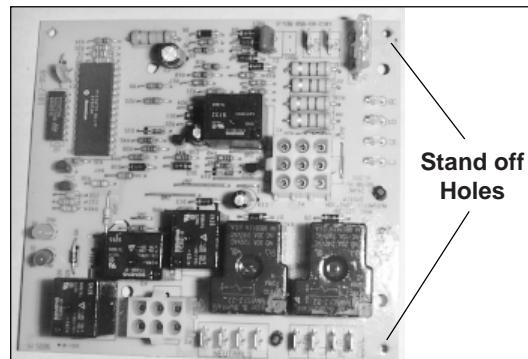
Jump out R to W at thermostat with 10 Loop Helex and measure current draw after blower starts. Divide by 10. Example: 4 Amps = .4 set at .4.

Limit Control (Picture 14) – This furnace is protected by two high temperature safety limit switches. The auxiliary (upper) limit switch and the high temperature (lower) limit switch are automatic reset types. If either limit trips, the burner will shut off, and status light will flash "1".

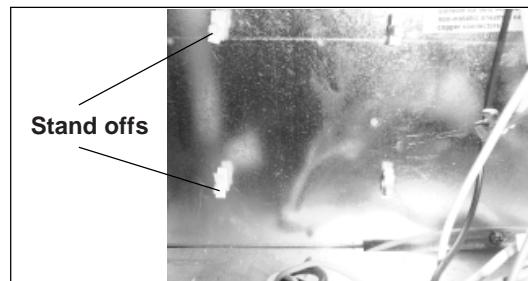
M1M-Control Board Replacement

Replace the control board only after determining a failure has occurred in it. Most problems that are blamed on control are actually external to control. (See troubleshooting section). If control has failed, use the following procedure to replace.

1. Disconnect power to unit by turning off power switch.
2. Disconnect molex plugs and all push on terminal connections. Note connections for rehook up.
3. After all wire connections have been removed you must squeeze the four white stand offs to remove board. See Pictures 13 showing board removed with exposed standoffs remaining.
4. Carefully line up holes (Picture 12) on the new board over standoffs, and push into place. **Caution:** push from outside edge only - be careful of fragile components.
5. Reinstall all molex plugs and wires removed in step 2.
6. Apply power and re-test.



Picture 12. UTEC Ignition Control



Picture 13. Ignition Board Removed

Ignition Control Troubleshooting

CONTROL LIGHT STATUS	
RED	
Steady ON	Control OK
Steady OFF	No power
Rapid Flash	False flame or internal control fault
1 Flash	Limit switch is open
2 Flashes	Pressure switch is open with inducer on
3 Flashes	Pressure switch is closed with inducer off
4 Flashes	Lockout due to failed ignition
5 Flashes	115 vac & neutral reversed or no ground
YELLOW	
Steady ON	Good Flame Signal
Blinking	Weak Flame Signal
Steady OFF	No Flame Signal



Picture 14. Limit Switch

- Power Line Polarity** – The “hot” side of the power line must be connected to the “L1” for the control to be able to sense flame. The control detects the reversal of “hot” and neutral. When L1 and Neutral are switched (or L1 is not present), the control flashes “5” on the Status LED and locks out.
- Interrupted Thermostat** – If the thermostat demand for heat is removed before the flame recognition period, the control will run the inducer for the post purge period and de-energize all outputs.
- Ignition Re-Try** – If flame is not established on the first trial for ignition period, the gas valve is de-energized and the inducer remains energized for an inter-purge period of 30 seconds. The ignitor is then re-energized and the control initiates another trial for ignition. This sequence repeats for up to 5 trials for ignition.
- Ignition Re-Cycle** – Flame must not be sensed for 1 second before the control responds to a loss of flame. If flame is established and maintained during the trial for ignition period and then flame is lost, the gas valve is de-energized within 2 seconds, the induced draft motor continues to run, and the control begins timing the 45 second inter-purge delay. The indoor blower motor will be energized and/or remain energized on heat speed for the selected delay off time.

When the inter-purge delay is over, the ignitor is re-energized, and the control initiates another ignitor warm up and ignition activation period. The control will re-cycle up to 5 flame losses (4 re-cycles) within a single call for heat before going to lockout.

- Call for Continuous Fan/Cooling** – When a thermostat call for continuous fan (G) without a call for heat or cooling, the indoor fan is energized on the COOL speed after a .25 second delay. If a call for heat (W) occurs during continuous fan, the blower will de-energize.

A call for fan is ignored while in lockout.

- Limit Switch Operation** – Any time the limit switch opens, the gas valve and ignitor will be de-energized, the indoor blower motor will run on heat speed, and induced draft motor will run continuously. Control status LED flashes “1.”

When the switch re-closes, the induced draft motor will run through post-purge and the indoor blower will run through the selected fan off delay. The control will return to normal operation after the blower off delay is completed.

- Pressure Switch** – The control shall ignore pressure switch openings of less than 1 second (the gas valve will momentarily de-energize while the pressure switch is open, this may cause a loss of flame). To prevent pressure switch faults from being treated as flame losses, the control checks to see if the pressure switch has been

open momentarily within 2 seconds prior to the flame loss. If the pressure switch was open any time within the 2 seconds prior to a flame loss, the control assumes the flame loss was due to the open pressure switch and responds as described below.

If the pressure switch opens for more than 1 second after flame has been established, the control shall de-energize the gas valve, run through a normal 30 second post-purge and selected heat blower off delay. When the blower off delay is complete, the control shall start an ignition sequence if the thermostat is still calling for heat.

If the pressure switch opens for more than one second during a pre-purge or inter-purge, the control shall wait for the pressure switch to close. The purge time re-starts when the pressure switch closes. The control status LED will flash “2.” If the pressure switch is closed when the call for heat occurs, the control will begin to flash “3” on the status LED after 10 seconds and wait indefinitely for the pressure switch to open.

- Flame sense** – Flame is normally sensed through the hot surface ignitor using flame rectification. Open circuit flame sense voltage should be approximately 120 VAC line voltage. Minimum flame current required to sense flame is 0.5 microamps DC. Normal microamps is 3 or higher. To test, install microamp meter in series with ground (9) pin. If flame light is on solid microamp signal is at least 1 microamp. If flame light is blinking, flame signal is between 0.5 and 1 microamp, indicating a weak signal. Check for ignitor positioning and proper ground.

- Undesired Flame** – If flame is sensed longer than 4 seconds while the gas valve is de-energized, the control shall energize the induced draft motor and indoor blower on heat speed. When flame is no longer sensed, the induced draft motor will run through post-purge and the indoor blower motor will run through the selected heat fan off delay time. The control will do a soft lockout, but will still respond to open limit and flame. The Status LED will flash rapidly when lockout is due to undesired flame.

- Lockout** – The control shall not initiate a call for heat or call for continuous fan while in lockout. A call for cooling operates as normal. The control will still respond to an open limit and undesired flame.

Lockout will automatically reset after 1 hour. Lockout may be manually reset by removing power from the control for more than 1 second or removing the thermostat call for heat for more than 1 and less than 20 seconds (The 20 second time limit prevents electronic thermostats from automatically resetting lockout).

- Power Interruption** – The control will not interrupt its operational sequence from power interruptions less than 80 mS in duration. Relay outputs will momentarily de-energize during the interruption.

Power interruption greater than 80mS may cause the control to interrupt the operating sequence and resume as if power was first applied. All power interruptions of any duration are to be self recovered and not result in a condition that could cause lockout.

12. Control Internal Diagnostics

- a.) Internal microprocessor tests: The software will perform tests of the internal microprocessor hardware as much as is practical. A detected failure in internal hardware will result in lockout with the Status LED blinking rapidly.
- b.) Flame sense circuitry diagnostics: The integrity of the flame sense circuitry is constantly monitored by the microcontroller. The control will lock out with the status LED flashing rapidly if a fault is detected in the flame sense circuitry.
- c.) Failed gas valve relay: If the control senses the gas valve output as energized when it should be de-energized, and flame is not present, the control shuts off all control outputs (including the inducer motor) to force the pressure switch to open. If gas valve remains sensed as energized 15 seconds after the inducer shut off, the inducer is re-energized to attempt to vent the uncontrollable gas.

If the control senses the gas valve output as energized when it should be de-energized, and flame is present, the control keeps the inducer motor and indoor blower motor energized until flame is removed.

If the control does not sense that the gas valve is energized when it should be, the control locks out with the Status LED flashing rapidly.

Combustion Air Blower – All M1M models use a combustion air blower incorporated in series with the air inlet pipe. Its purpose is to supply a forced draft method of combustion air. The quality of air is determined by the inlet orifice ring, located on the inlet to the motor assembly.

Upon a call for heat under normal conditions, the combustion blower starts up and supplies combustion air to the chamber. If motor does not start, check to be sure call for heat is established and fault light is on solid. See troubleshooting flow chart and sequence of operation for further details. Then disconnect blower molex plug and check for voltage at plug. If voltage is available and motor does not start replace motor. If power is not available check back through power source and combustion blower relay contacts. See wiring diagram.



Picture 15. Combustion Air Blower

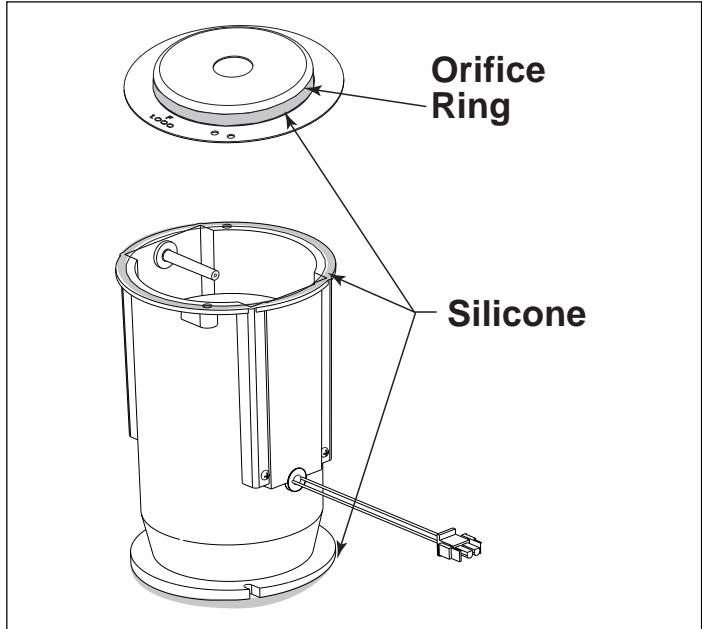


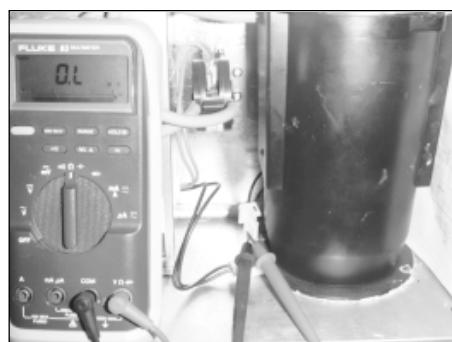
Figure 23. Combustion Air Blower



Picture 16. Blower Voltage



Picture 17. Blower OHM



Picture 18. Blower Open Motor

Combustion motor assembly replacement

Using the information from above you have determined the combustion motor assembly needs to be replaced, follow the outlined procedures.

1. Disconnect Molex plug
2. Remove screws from the top and break silicone loose from orifice ring on top side of ventor assembly. Figure Picture #26 inlet pipe may also break loose, this is normal.
3. Remove screws from bottom of assembly and remove the whole assembly.
4. Mount new assembly, reattach screws to bottom remove from step 3.
5. Re-silicone orifice ring and combustion air pipe and reinstall screws to top removed in step 2.
6. Reconnect Molex plug from step 1 and test.

Pressure Switch (Picture 19) – All M1M furnaces use a differential type pressure switch. The purpose of this switch is to insure that a good supply of combustion air is supplied to the burner. The combustion blower creates a differential in negative pressure (less than atmospheric pressure) across the orifice ring. The switch is normally open and closes on a drop in pressure, read in negative inches of water column.



Picture 19. Pressure Switch

Lower (Lesser) Differential Negative Pressure Than Closing Pressure

Insufficient negative pressure measured at the combustion blower may be caused by:

1. Restriction on outlet side of combustion blower (blocked flue or debris building up in flue).
2. Leak (lack of restriction) on inlet side. Inducer inlet leaking, inducer blower props loose, or wrong restrictor orifice.
3. To test for restriction in outlet pipe (exhaust) to verify problem is outside of furnace, disconnect exhaust for test period only and start furnace. If furnace starts, look for problem in vent pipe. Reconnect after testing.

Under normal operating conditions, once the ventor motor builds up to speed sufficient differential (negative) pressure (approximately -0.30" wc) will be created to close the differential pressure switch and keep it closed the whole heating cycle. Under abnormal conditions, such as ventor motor failure, or restricted air inlet or vent, sufficient differential pressure will not be created.

Under most circumstances, when the pressure switch is not going closed, insufficient differential (negative) pressure is not being created. See Table 9 for opening and closing settings.

Pressure switch check out procedure:

1. Remove orange wires from pressure switch. Place tees in the bases connecting pressure switch to combustion blower assembly.
2. Connect a differential pressure gauge (magnehelic or equivalent) to the tees. The magnehelic connection marked low connects to the lower tee, and the one marked high connects to the top tee.
3. Start motor.
4. Negative pressure created by the forced draft motor must be greater than -0.30" w.c. for the switch to close.
5. Use the ohm meter to check for continuity across the switch.
6. If continuity is established, switch has closed. If ohm meter shows infinite reading, and a pressure of -.30" w.c. or higher is present, switch is open, and must be replaced.

If the pressure differential reading will not pull down to -.30" w.c., possible causes could be:

1. Restriction in air inlet pipe, this causes a greater negative at the inlet side connection. This will act to open switch. To prove this, disconnect the hose going to the top connection. If switch closes, there is too much negative pressure being created on the inlet side. Look for air inlet restriction.

Higher than normal negative pressure at top connection (acts to open switch) may be caused by:

1. Restricted combustion air inlet pipe.
2. To verify if problem is in inlet pipe, disconnect pressure switch hose at top connection and start furnace. If furnace starts, look for problems mentioned above in inlet pipe. Note: top connection acts to open contacts on differential switch.

NOTE:

Inlet Pressure - Outlet Pressure = Differential Pressure

Table 9. Lower (lesser) Differential Negative Pressure Than Closing Pressure

2. If there is a heat exchanger restriction or exhaust restriction (any restriction after motor), it will cause a lack of negative pressure. If flow out of chamber (exhaust) is poor no air will be drawn in. Clean chamber and recheck.
3. If motor is not running, no negative will be created and assembly will have to be replaced. (See combustion air assembly replacement)
7. The ignitor may also be ohmed out. The ignitors usually range from 125 to 150 ohms at 70°F/21°C.
8. Be sure when replacement ignitor is installed that it is approximately 5/16" from the burners. Mishandling and misalignment are the primary causes of ignitor failure.

Hot Surface Ignitor – The hot surface ignitor is helical in shape and is located approximately 5/16" in front of the burners. Its function is to ignite fuel at the appropriate time in the sequence. The hot surface ignitor used is manufactured by CARBORUNDUM.

NOTE: Special care should be taken when handling the ignitor. You should never touch the ignitor surface. Grease or dirt from your hands will shorten the ignitor's life.

Check-out Procedure:

1. Unplug ignitor from 2-prong plug.
2. Place a voltmeter on the proper scale (at least 115 vac).
3. Establish a call for heat.
4. After approx. 45 seconds of induced draft motor operation, the ignitor should see line voltage.
5. If voltage is present, replace the ignitor. (See Figure 41.)
6. If no voltage is present, replace control board.



Picture 20. Hot Surface Ignitor



Picture 21. Ignitor and Voltmeter



Picture 22. Test Hot Surface Ignitor

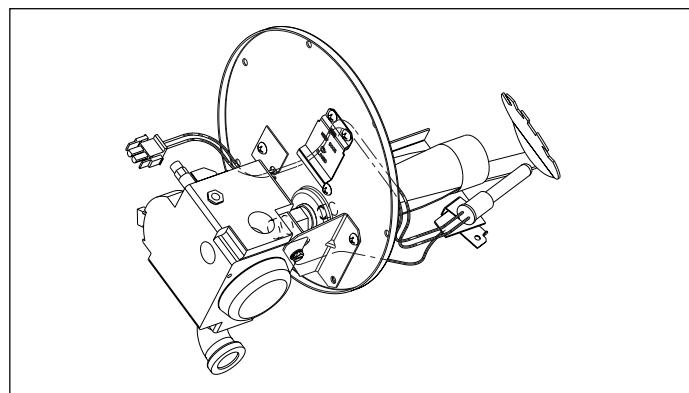


Figure 24. M1M Burner Assembly

Burner Assembly – In order to perform procedures such as inspecting for presence of LP gas in chamber, cleaning burner, and inspecting the heat exchanger, the burner assembly must be removed.

Changing Complete Burner Assembly

1. Gas Line - Remove the furnace door then disconnect and remove the gas line from the valve body by using two backup wrenches. Be careful not to damage the pipe threads or introduce dirt into the gas line.
2. Wiring Leads - Remove the two low voltage wiring leads from the valve body by carefully pulling them off the connectors. Be careful not to damage or dirty the connector ends.
3. Main Burner Mounting Plate- Using a philips, remove the screws that hold the main burner mounting plate to the furnace.
4. Burner Assembly- Slide the burner assembly out from the furnace.
5. Reverse procedure to reinstall.

NOTE: Be sure to install the gasket.

Gas Valve - The gas valves for the gas furnaces are a 100% shut-off type and will fail safe if for some reason the gas is turned off.

When the thermostat calls for heat, the first and second valves open by the energization of two solenoids. If 24 vac is available at valve and no gas flows, valve is defective. NOTE: Be sure gas pressure is available at the inlet to the valve and does not exceed 14" w.c. (1/2 lb.). If this condition exists, valve will lock down and no gas will flow through it.

Step Flow: during the dwell time, there is no flow through the main valve since it is closed. A calibrated bypass hole provides step flow, for soft ignition and draft build up, during the dwell time. The bypass flow can be custom tailored from 40% to 70%

of full flow, but is also *not* field adjustable. At the end of the dwell time, the main valve opens, allowing full gas flow.

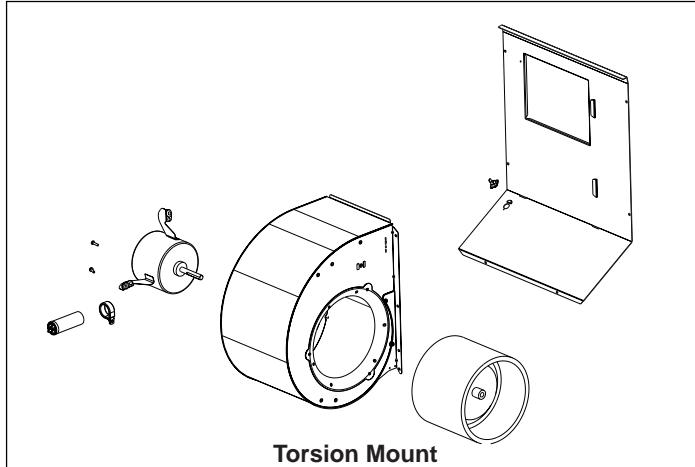
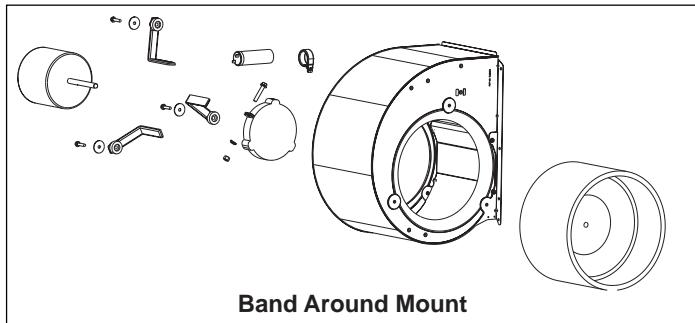
Testing Operating Pressure:

- a. Remove furnace door and set the gas valve in the OFF position.
- b. Using a 3/16" Allen wrench, remove the plug from the right side of the valve.
- c. Install the barbed adapter in the plug hole. Tighten by hand at first, then with an open end wrench. Do not overtighten!
- d. Install the hose and manometer to the barbed fitting. Be sure to check all connections for leaks.
- e. Set the gas valve switch to the ON position.
- f. With the valve in the ON position, set the thermostat above room temperature so the furnace will run throughout the test procedure.
- g. With the furnace operating, check for valve staging. The operating pressure should be 3.5" WC for Natural Gas, 10" WC for LP gas.

Blower Assembly – If the blower motor has power to it (heating speed and neutral) and motor does not start, motor has electrically opened up. **NOTE:** Some models incorporate a capacitor, this should be checked first.

To replace motor:

1. Remove wires going to motor.
2. Remove single Phillips screw in upper left corner.
3. Raise entire blower assembly slightly and swing out to left.
4. Loosen set screw on blower hub.
5. Remove screws holding motor to blower housing.



Picture 23. Blower Assemblies

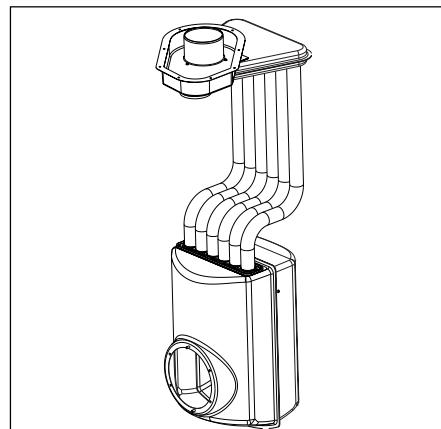
6. Remove motor and replace. NOTE: Some motors are torsion-flex mount and some are band around mount. See picture below.
7. Reverse steps 1-5 to reinstall. Note: Be sure to tighten blower set screw on flat of motor shaft.

Heat Exchanger Replacement – The heat exchanger is the largest and most expensive item in the furnace. Before replacing the heat exchanger, make certain it is the problem. Call the technical service department if you have any uncertainty about a heat exchanger failure. **Heat exchangers can become sooted up due to debris in top of furnaces, improper conversion, or not being converted to LP. See troubleshooting section on flue and conversion section of this manual. This condition is not covered under warranty. See page 22 of this manual – To Test Heat Exchanger.**

Note: The furnace does not have to be removed to replace the heat exchanger.

Change Out Procedure:

1. Disconnect all gas and electrical power to furnace.
2. Disconnect flue.
3. Remove burner assembly.
4. Remove combustion air pipe and combustion blower.
5. Remove blower assembly.
6. Remove blower deck panel. NOTE: Panel will be difficult to remove with furnace in alcove.
7. Remove front panel. NOTE: One of the panel screws is located through the combustion air box on the right.
8. Lift up divider panel out of side cabinet lances.
9. Support the underside of the heat exchanger with a board.
10. Remove top collector panel. NOTE: Two screws attach through top of cabinet.
11. Remove the other eight screws in the top of the cabinet that hold the combustion air box.
12. Remove heat exchanger and replace.
13. Reverse steps one through eleven to reinstall. NOTE: Be sure to install all new gaskets (from gasket replacement kit).
14. Start up and check out for proper operation.



WIRING DIAGRAM

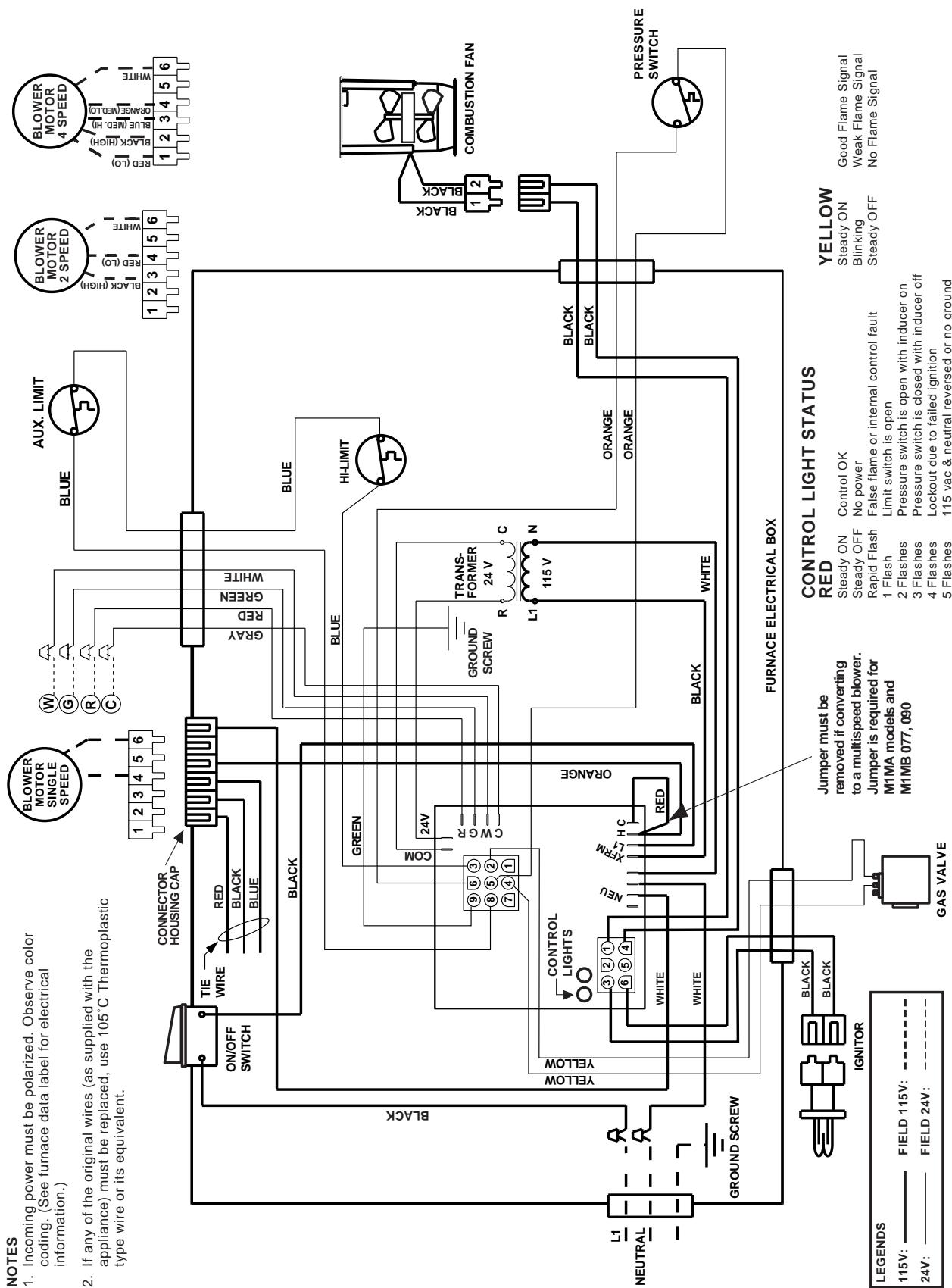


Figure 25. Gas Direct Ignition Furnace, Heating & A/C Ready - All M1M Models

